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DrägerService®

Dräger

Technical Service Manual

Part Number: 4112259-001
Rev: AB
Date: 20 May 2002
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Narkomed 2C Anesthesia System

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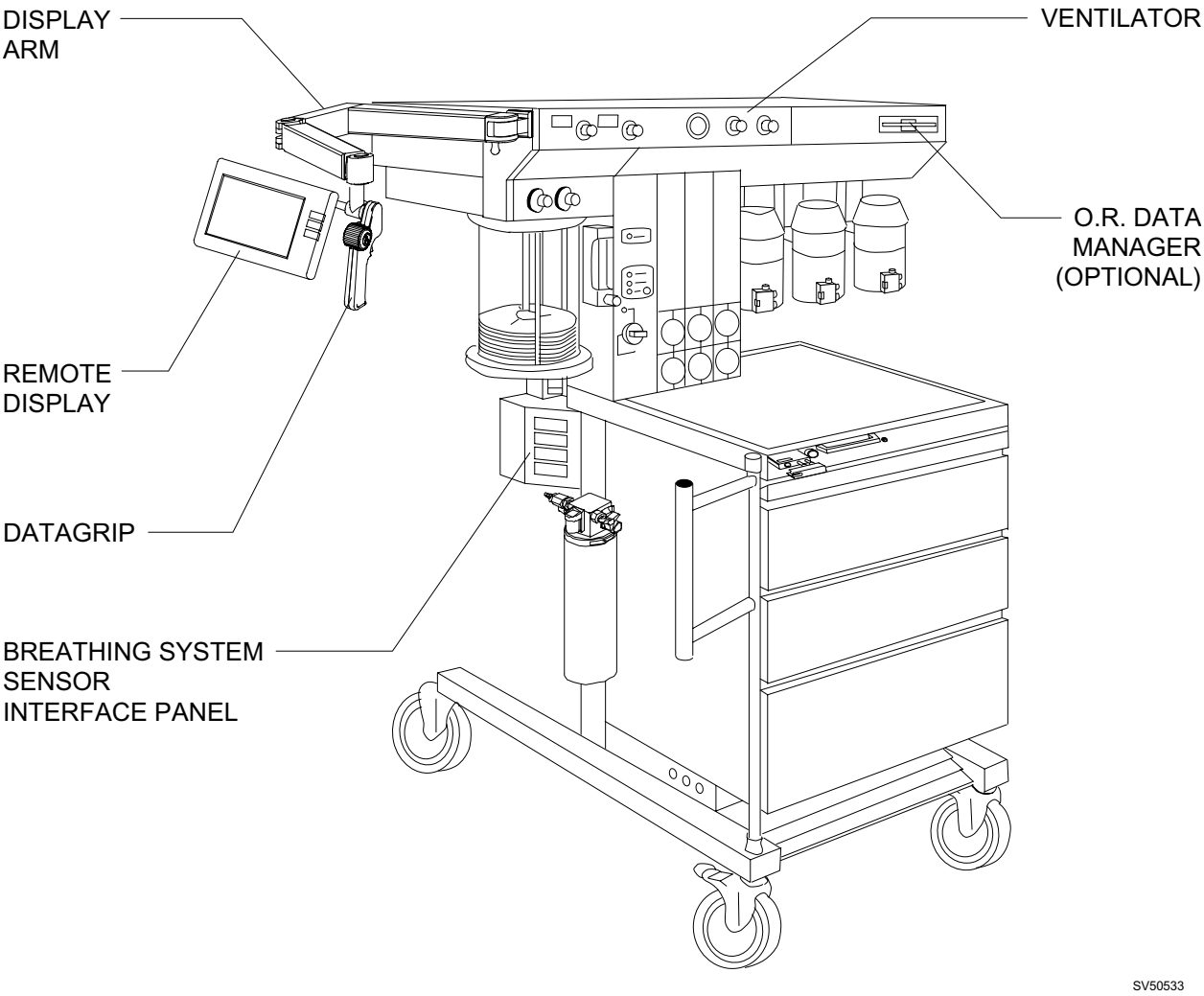

1.0 RECOMMENDATIONS

Because of the sophisticated nature of Draeger Medical, Inc. anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService® at (800) 543-5047 for service of this equipment.

Draeger Medical, Inc. also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical, Inc. For further information concerning these agreements, please contact us at Draeger Medical, Inc.(800) 543-5047.

Draeger Medical, Inc. products/material in need of factory repair shall be sent to:

DrägerService
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

HOW TO USE THIS MANUAL

The manual is divided into several sections. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section lists error codes and provides troubleshooting guides to assist the TSR in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

GENERAL TROUBLESHOOTING GUIDELINES

Troubleshooting the Narkomed 2C should always begin by communicating with those who observed or experienced a problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 to determine the proper corrective action to be taken.

After a component has been replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMS PROCEDURE in Section 6 must also be performed after any component has been replaced.

The general arrangement of the Narkomed 2C Anesthesia System is shown on the opposite page.

WARNINGS are used in this manual before procedures which if not performed correctly could result in personal injury.

CAUTIONS are used in this manual to alert service personnel to the possibility of damage to the equipment if a procedure is not performed correctly.

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2.0 DIAGNOSTICS

The Narkomed 2C contains a diagnostic system that monitors certain system functions and records their operational status. A series of tests is performed when the system is powered up and the results are displayed on the diagnostics screen shown in Figure 2-1. The display also includes one of three messages at the completion of the diagnostics:

FUNCTIONAL: This message indicates that the NARKOMED 2C has passed all power-up tests and is fully functional. The machine will proceed to the MACHINE MONITOR screen after a short delay.

CONDITIONALLY FUNCTIONAL: This message indicates that a minor problem has been detected. The NARKOMED 2C will retain this display until the trigger is pressed, then the MACHINE MONITOR screen will be displayed.

NON-FUNCTIONAL: This message indicates that a serious problem has been detected. The machine will not proceed into the MACHINE MONITOR or SYSTEM MONITOR screen.

Further diagnostic functions are available through service screens that can be called up at the display panel. The following paragraphs provide a description of each service screen that can be accessed at the display. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.

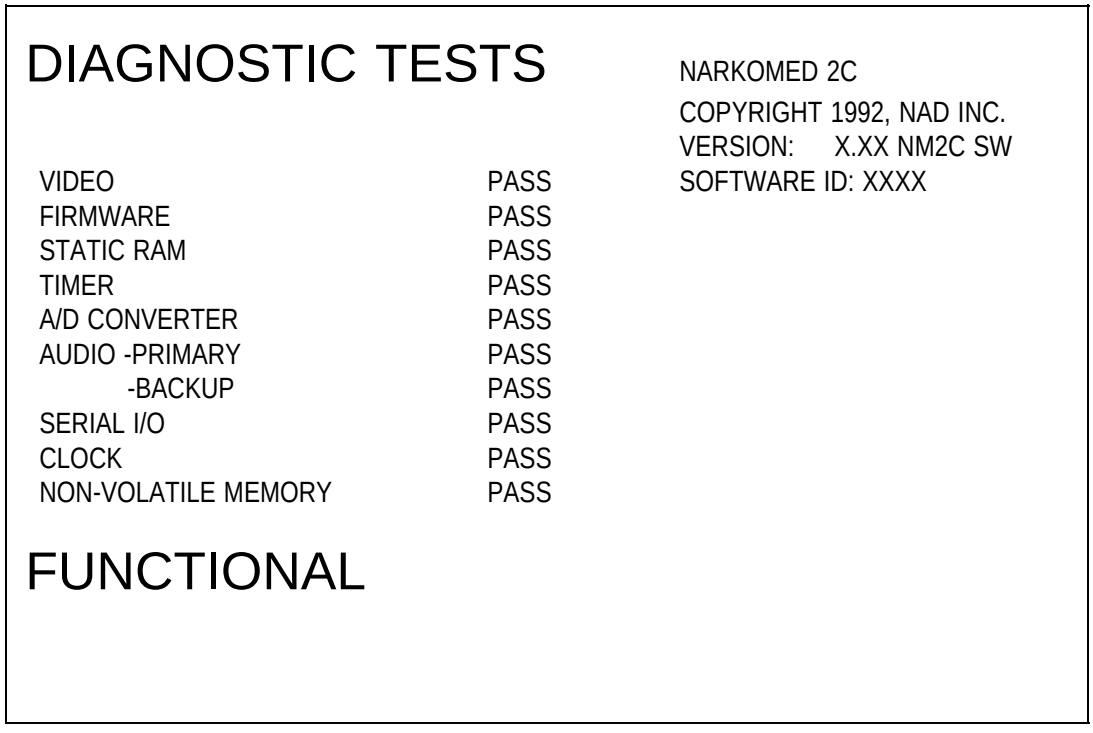


Figure 2-1: POWER-UP DIAGNOSTICS SCREEN

2.1 Main Service Screen

2.1.1 View Mode

The Main Service Screen displays the machine serial number, the last service date, hours run since last service and total hours run. Selections listed on the right side of the display allow entry into additional service screens.

To access the Main Service Screen, press and hold the VENTILATION ALARMS OFF and keys, and press the Datagrip trigger. The View Mode service screen shown in Figure 2-2 will then appear. (The VENTILATION ALARMS OFF key was labeled LOG DATA on earlier machines.)

If the MONITORS service screens are accessed in the view mode, current values will be displayed but the operator will not be able to perform calibrations.

Additional service mode screens are described in the next paragraph. These are accessed by pressing the trigger, which will highlight VIEW. Then scroll to the desired service mode with the selection wheel and press the trigger.

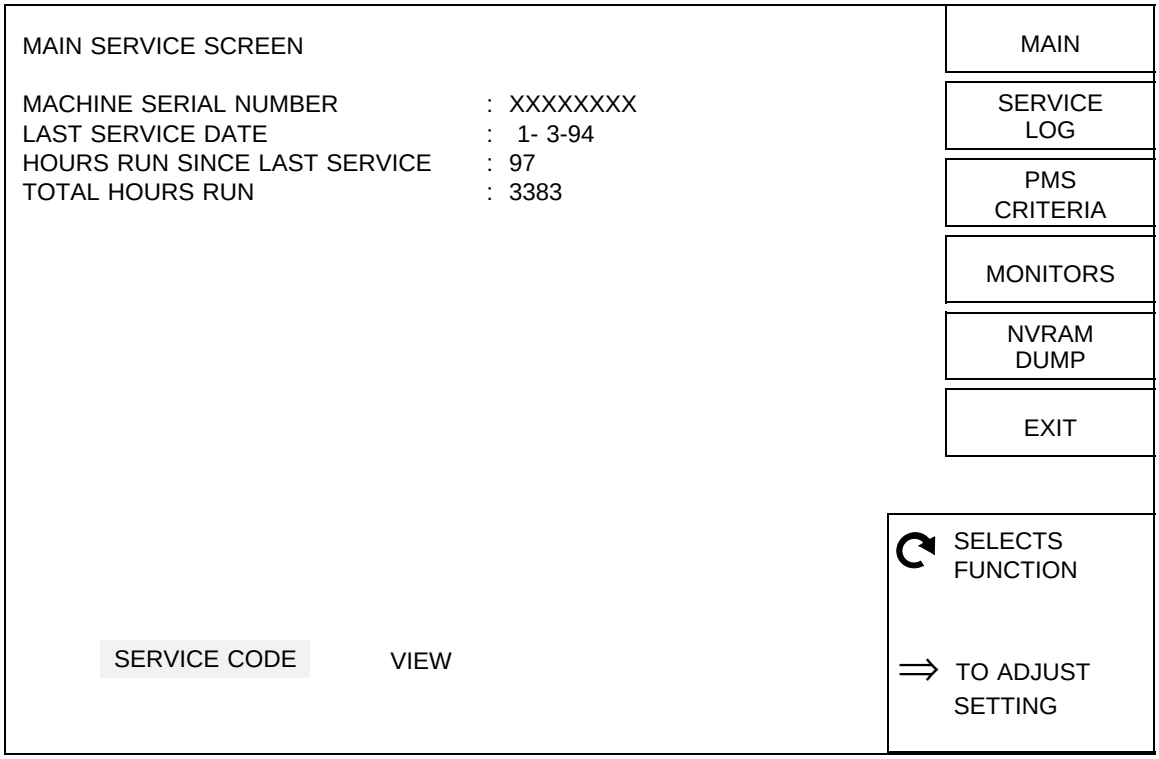


Figure 2-2: MAIN SERVICE SCREEN, VIEW MODE

2.1.2 Service Mode

The following additional service mode screens are available by selecting the appropriate Service Code:

PMS: For performing scheduled Periodic Manufacturer's Service
INST: For initial installation of the NM2C. This selection establishes the start date for the warranty period.
SRVC: For unscheduled service visits requiring component replacements or calibrations.

The Service Mode screen appears as shown in Figure 2-3. Press the trigger to highlight the first Technical Service Representative I.D. box; rotate the selection wheel until the first character of the I.D. appears, then enter the selection by pressing the trigger. Enter the remaining three I.D. characters in the same manner.

The selection wheel can now be used to select the service screens described in the following paragraphs. Selecting RESET and pressing the trigger will set the last service date to the current date, and the hours run since last service to zero. Selecting ORDM DISPLAY allows O.R. Data Manager diagnostic information to appear on the screen (pressing the trigger while in the ORDM mode returns the display to the Service Mode). Selecting EXIT and pressing the trigger will return the display to normal operation.

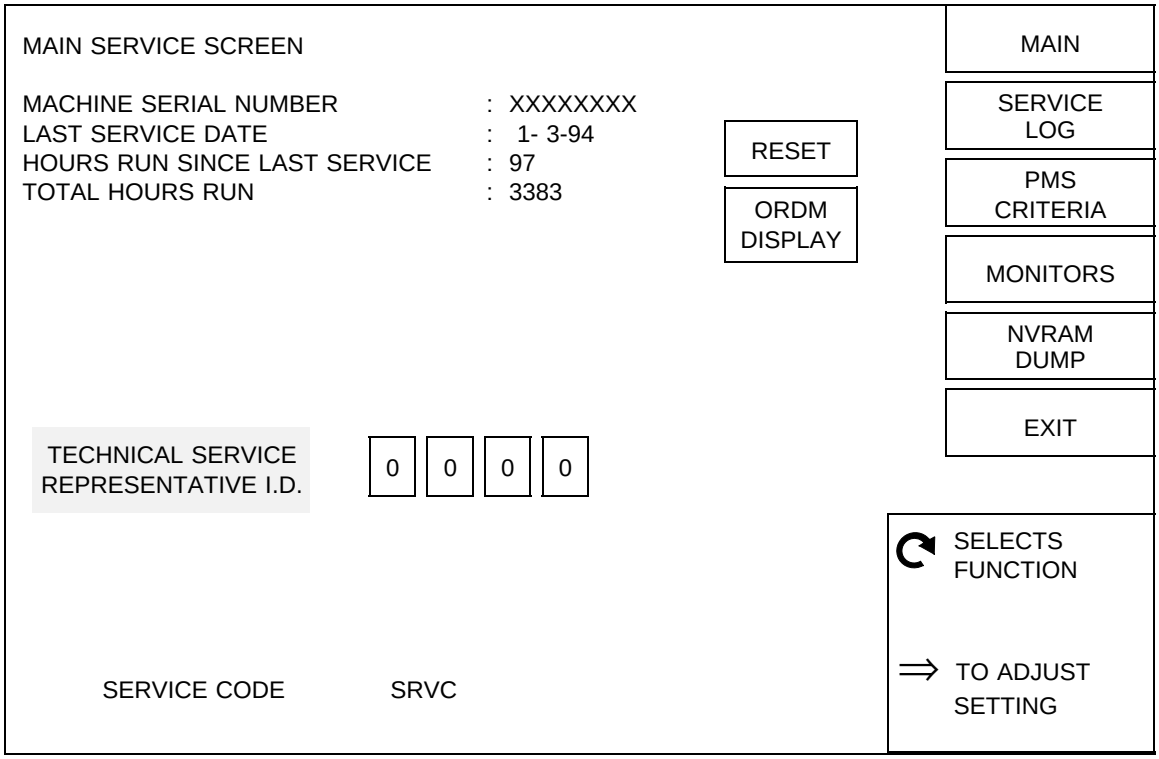


Figure 2-3: MAIN SERVICE SCREEN, SERVICE MODE

2.2 Service Log

The Service Log Screen displays a tabular listing of each service event including date, time, parameter, code and event description as shown in Figure 2-4.

To enter the Service Log screen from the Main Service Screen, highlight SERVICE LOG (ref. Figure 2-3) with the selection wheel and press the trigger.

With SCROLL LOG highlighted, press the trigger to enable scrolling through the list of service log entries with the selection wheel.

To obtain a printout of the service log (if you are in the Scroll mode, first return to the selection mode by pressing the trigger), select PRINT LOG and press the trigger to activate the printer.

Select EXIT and press the trigger to return the display to the Main Service Screen.

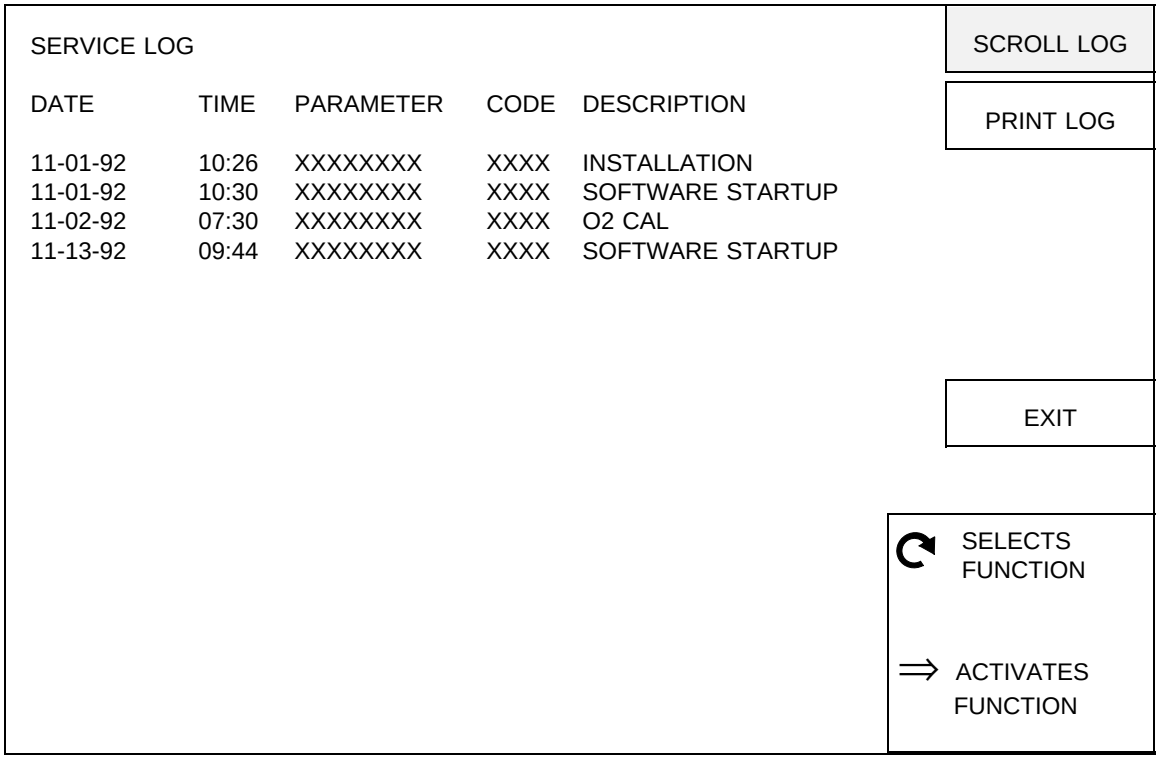


Figure 2-4: SERVICE LOG

2.3 PMS Criteria Screen

The PMS Criteria Screen allows a service representative to select for display the month of the next scheduled Periodic Manufacturer's Service. This screen is shown in Figure 2-5.

To enter the PMS Schedule Service Screen from the Main Service Screen, highlight PMS CRITERIA (ref. Figure 2-3) with the selection wheel and press the trigger.

Turn the selection wheel to indicate the desired month, and press the trigger to enter that month.

To return to the Main Service Screen, select EXIT and press the trigger.

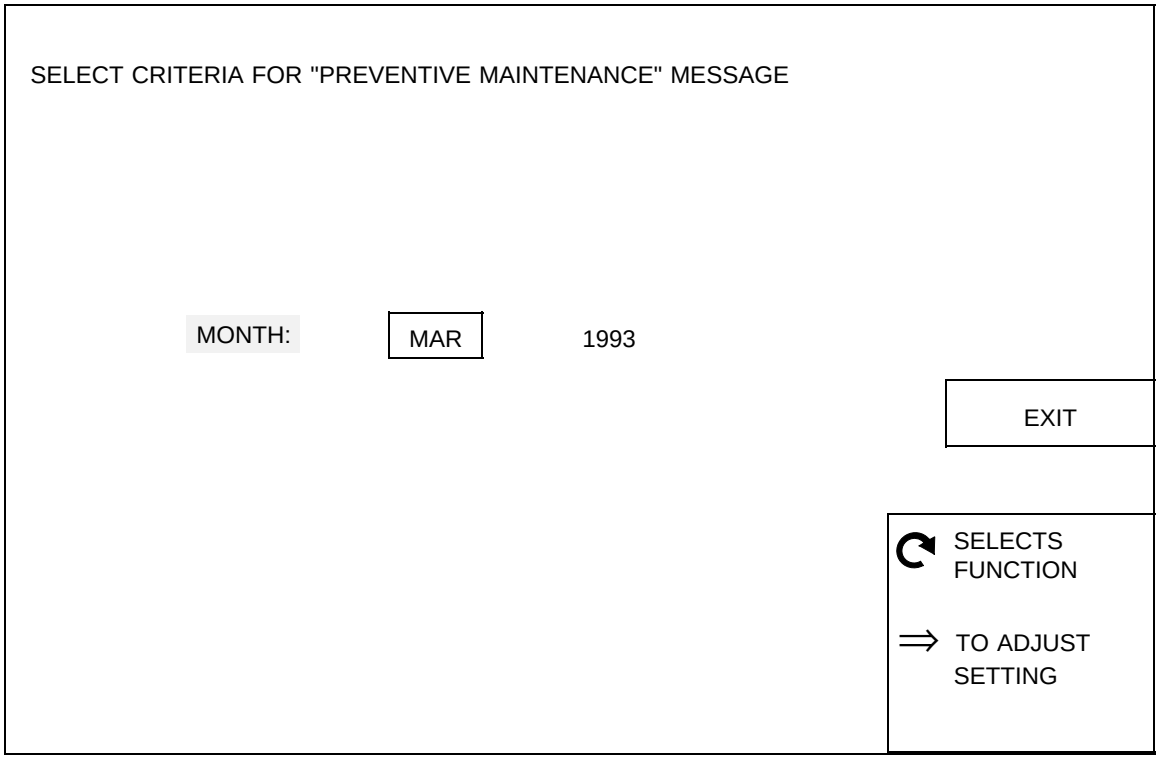


Figure 2-5: PMS CRITERIA SCREEN

2.4 Oxygen Monitor Service Screen

The Oxygen Monitor Service Screen shown in Figure 2-6 displays current readings for the O_2 cells, a zero calibration procedure, and the stored calibration values.

To enter the Oxygen Monitor Service Screen from the Main Service Screen, highlight MONITORS (ref. Figure 2-3) with the selection wheel and press the trigger.

To perform a zero calibration, highlight STORE ZERO with the selection wheel, and follow the calibration procedure shown on the screen. Pressing the trigger stores the current values as the new zero calibration.

To proceed to the Pressure Monitor Service Screen, select PRESSURE MONITOR and press the trigger. To return to the Main Service Screen, select EXIT and press the trigger.

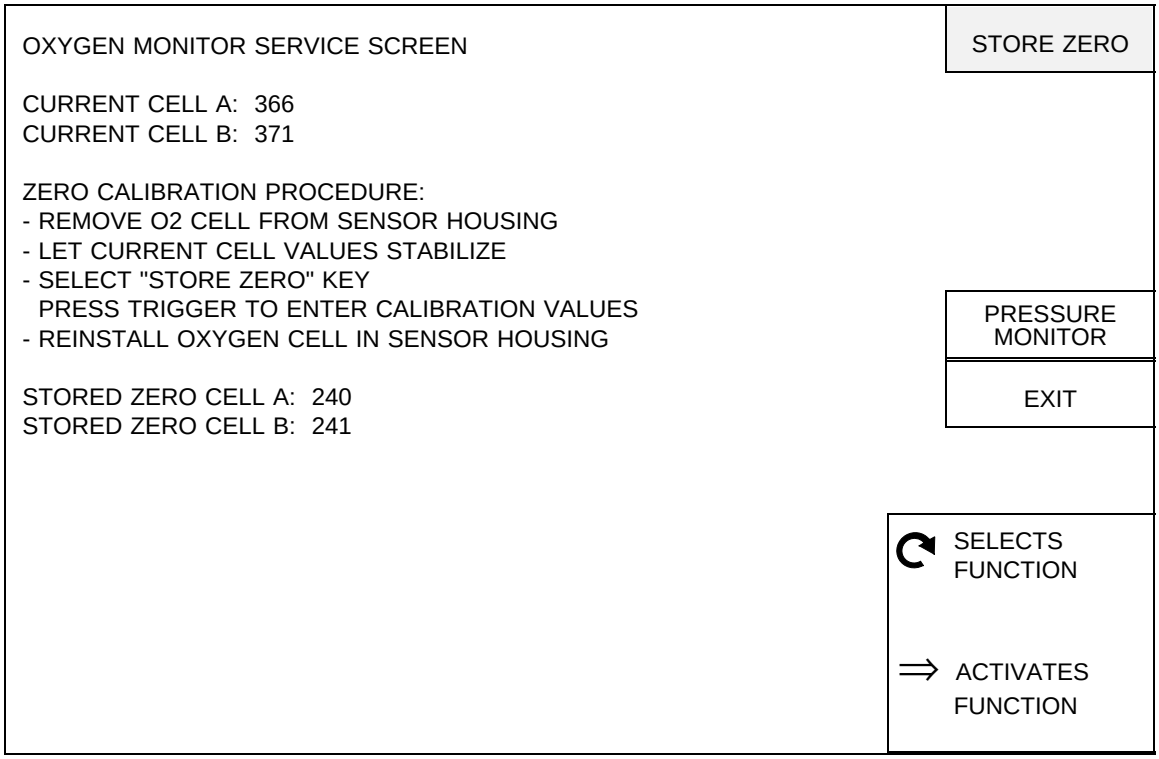

OXYGEN MONITOR SERVICE SCREEN
CURRENT CELL A: 366
CURRENT CELL B: 371
ZERO CALIBRATION PROCEDURE:
- REMOVE O2 CELL FROM SENSOR HOUSING
- LET CURRENT CELL VALUES STABILIZE
- SELECT "STORE ZERO" KEY
PRESS TRIGGER TO ENTER CALIBRATION VALUES
- REINSTALL OXYGEN CELL IN SENSOR HOUSING
STORED ZERO CELL A: 240
STORED ZERO CELL B: 241
STORE ZERO
PRESSURE MONITOR
EXIT
SELECTS FUNCTION
ACTIVATES FUNCTION

Figure 2-6: OXYGEN MONITOR SERVICE SCREEN

2.5 Pressure Monitor Service Screen

The Pressure Monitor Service Screen shown in Figure 2-7 displays the current reading for airway pressure, a procedure for zero and span calibration, and the stored calibration values.

To enter the Pressure Monitor Service Screen from the Oxygen Monitor Service Screen, highlight PRESSURE MONITOR (ref. Figure 2-6) with the selection wheel and press the trigger.

To perform a zero calibration, highlight STORE ZERO with the selection wheel and follow the procedure shown on the screen. Pressing the trigger stores the current value as the new zero calibration.

To perform a span calibration, highlight STORE SPAN with the selection wheel and follow the procedure shown on the screen. pressing the trigger stores the current value as the new span calibration.

To return to the Oxygen Monitor Screen, select OXYGEN MONITOR and press the trigger. To return the Main Service Screen, select EXIT and press the trigger.

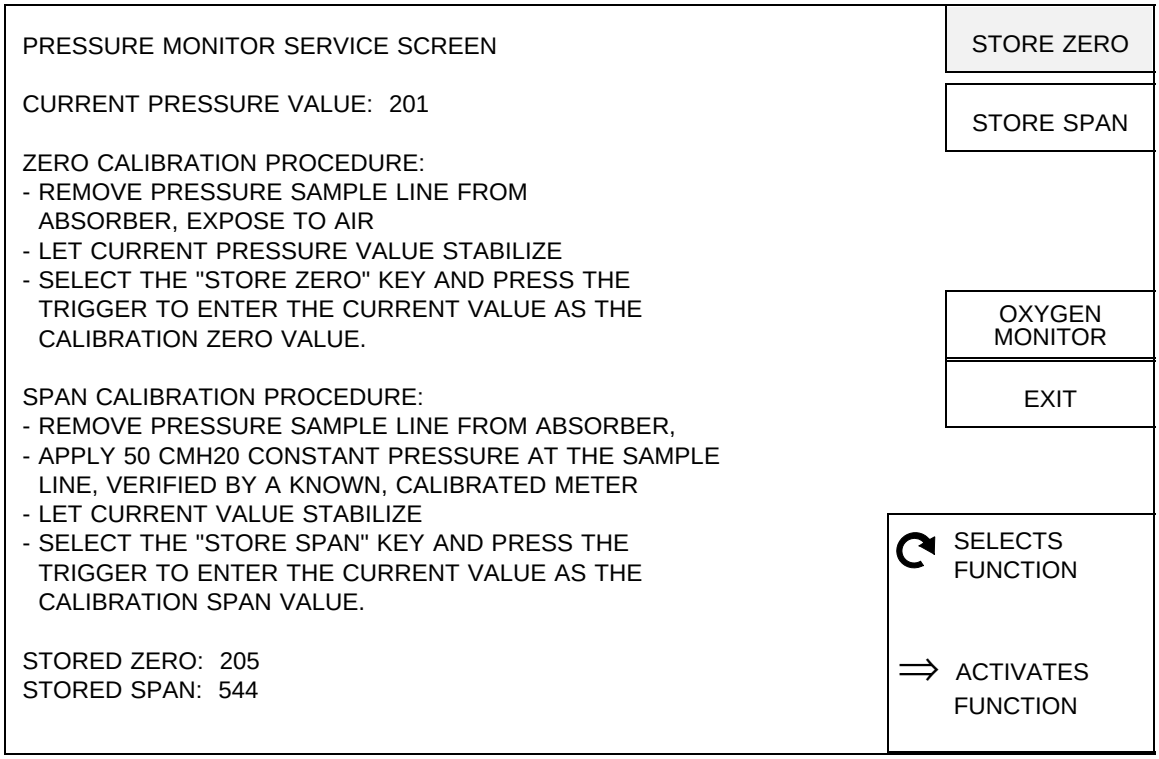

PRESSURE MONITOR SERVICE SCREEN
CURRENT PRESSURE VALUE: 201
ZERO CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, EXPOSE TO AIR
- LET CURRENT PRESSURE VALUE STABILIZE
- SELECT THE "STORE ZERO" KEY AND PRESS THE TRIGGER TO ENTER THE CURRENT VALUE AS THE CALIBRATION ZERO VALUE.
SPAN CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER,
- APPLY 50 CMH20 CONSTANT PRESSURE AT THE SAMPLE LINE, VERIFIED BY A KNOWN, CALIBRATED METER
- LET CURRENT VALUE STABILIZE
- SELECT THE "STORE SPAN" KEY AND PRESS THE TRIGGER TO ENTER THE CURRENT VALUE AS THE CALIBRATION SPAN VALUE.
STORED ZERO: 205
STORED SPAN: 544
STORE ZERO
STORE SPAN
OXYGEN MONITOR
EXIT
SELECTS FUNCTION
ACTIVATES FUNCTION

Figure 2-7: PRESSURE MONITOR SERVICE SCREEN

2.6 NVRAM Dump Screen

The NVRAM Dump Screen displays locations of non-volatile memory (processor status registers). This screen is shown in Figure 2-8.

To enter this screen from the Main Service Screen, highlight NVRAM DUMP (ref. Figure 2-3) with the selection wheel and press the trigger.

To obtain a printout of this screen, press the trigger (with PRINT highlighted). The register contents will be dumped to the printer port at 9600 baud.

To return to the Main Service Screen, select EXIT and press the trigger.

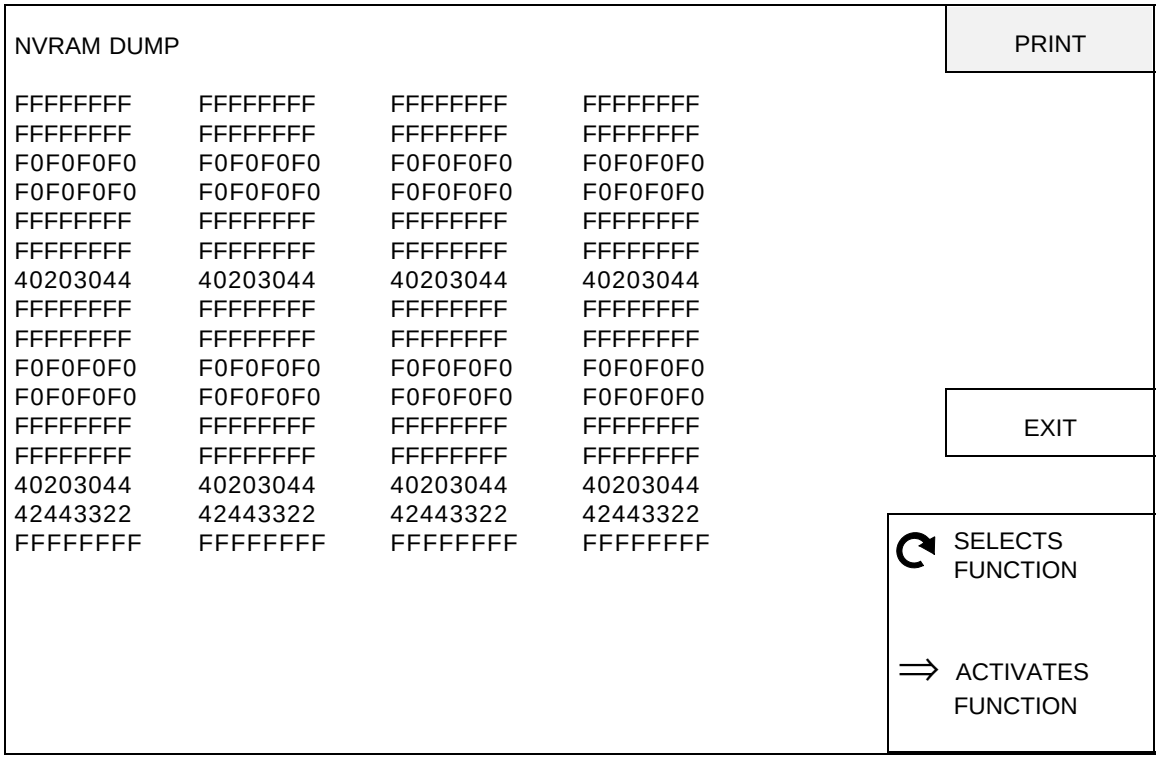


Figure 2-9: NVRAM DUMP SCREEN

3.0 TROUBLESHOOTING

This section contains information to assist the Draeger Medical, Inc. qualified Technical Service Representative (TSR) in locating electrical faults affecting the NARKOMED 2C monitoring and display devices. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraph outlines the voltage distribution scheme within the machine along with test points for each of the voltages.

3.1 Power Supply and Voltage Distribution

In the NARKOMED 2C, +5VDC, +12VDC and -12VDC are supplied to J15 on the processor board; +8VDC is supplied to J4 on the alarm channel and is also distributed to the ventilator controller via J3 on the alarm channel. These voltages can be measured at the connectors shown in Figure 3-1. Table 3-1 lists the acceptable range for each voltage under normal load conditions. Figure 3-2 shows a block diagram of the NARKOMED 2C, including the primary and secondary voltage distribution scheme.

TABLE 3-1: TEST POINTS AND ALLOWABLE RANGES

PROCESSOR	VOLTAGE	ACCEPTABLE RANGE
J15-14 (Pur)	+ 5 VDC	4.85 to 5.15 VDC
J15-4 (Yel)	+ 12 VDC	11.76 to 12.24 VDC
J15-13 (Orn)	- 12 VDC	-11.64 to -12.36 VDC
J15-15 (Blk)	Common	
ALARM CHANNEL	**VOLTAGE**	**ACCEPTABLE RANGE**
J3-9 (Wht)	+ 8 VDC	7.76 to 8.24
J3-3 (Orn)	Common	

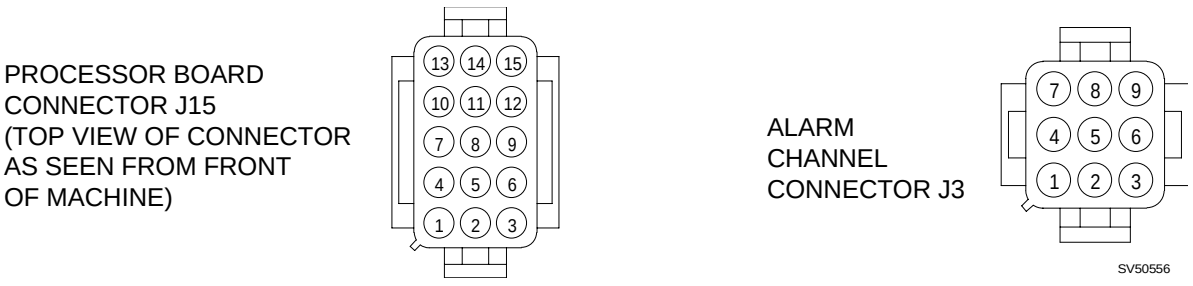


Figure 3-1: POWER SUPPLY TEST POINTS (REAR VIEW OF CONNECTORS)

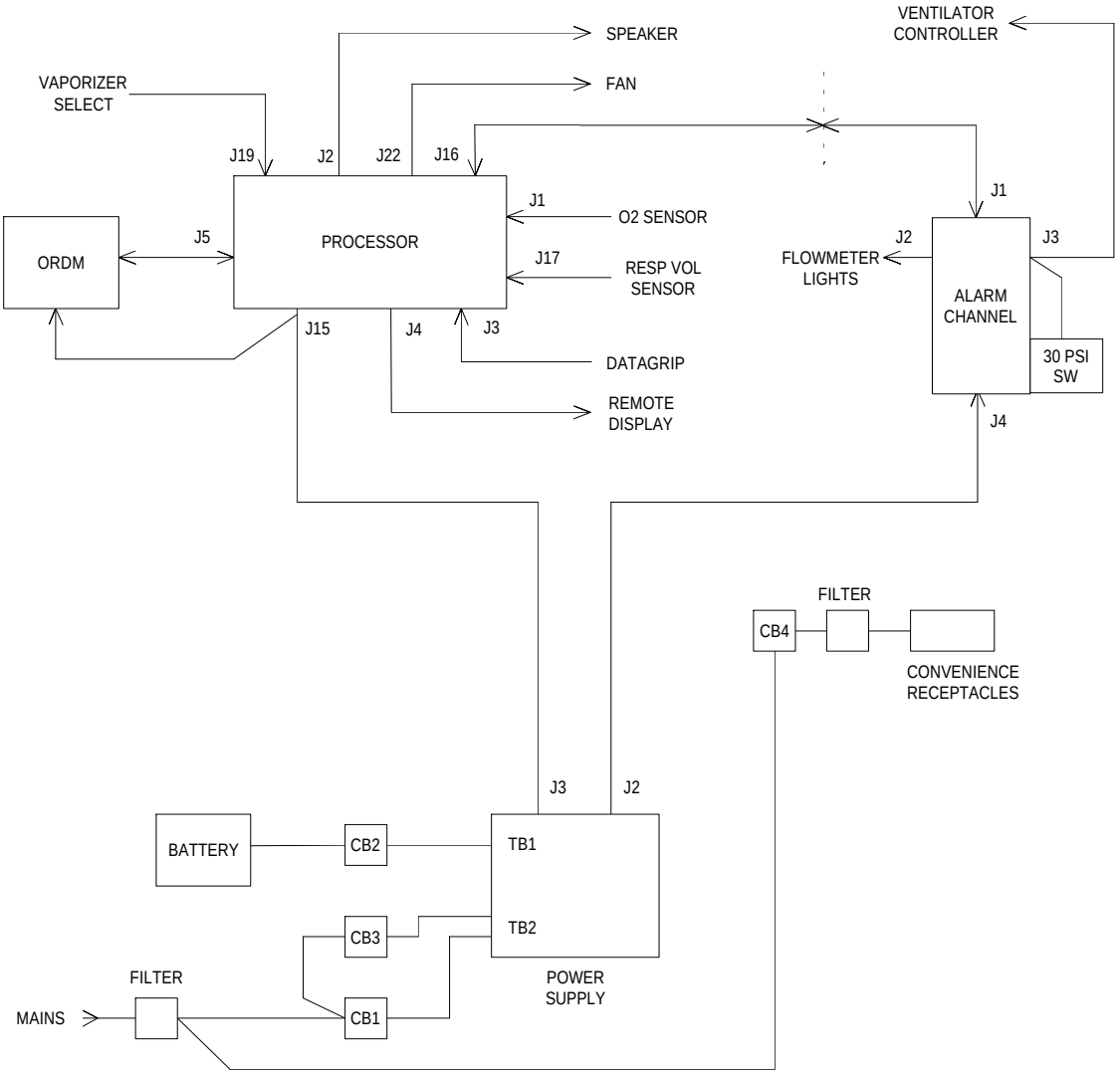


Figure 3-2: NARKOMED 2C BLOCK DIAGRAM (ELECTRICAL)

3.2 Battery

While the machine is operating from an AC line, the battery voltage at full charge should be within the range of 12.83 to 14.18 VDC. Battery voltage can be measured at TB1, terminals 1 and 2, on the power supply. During battery operation, the low battery cutoff voltage should be within the range of 10.5 to 10.0 VDC.

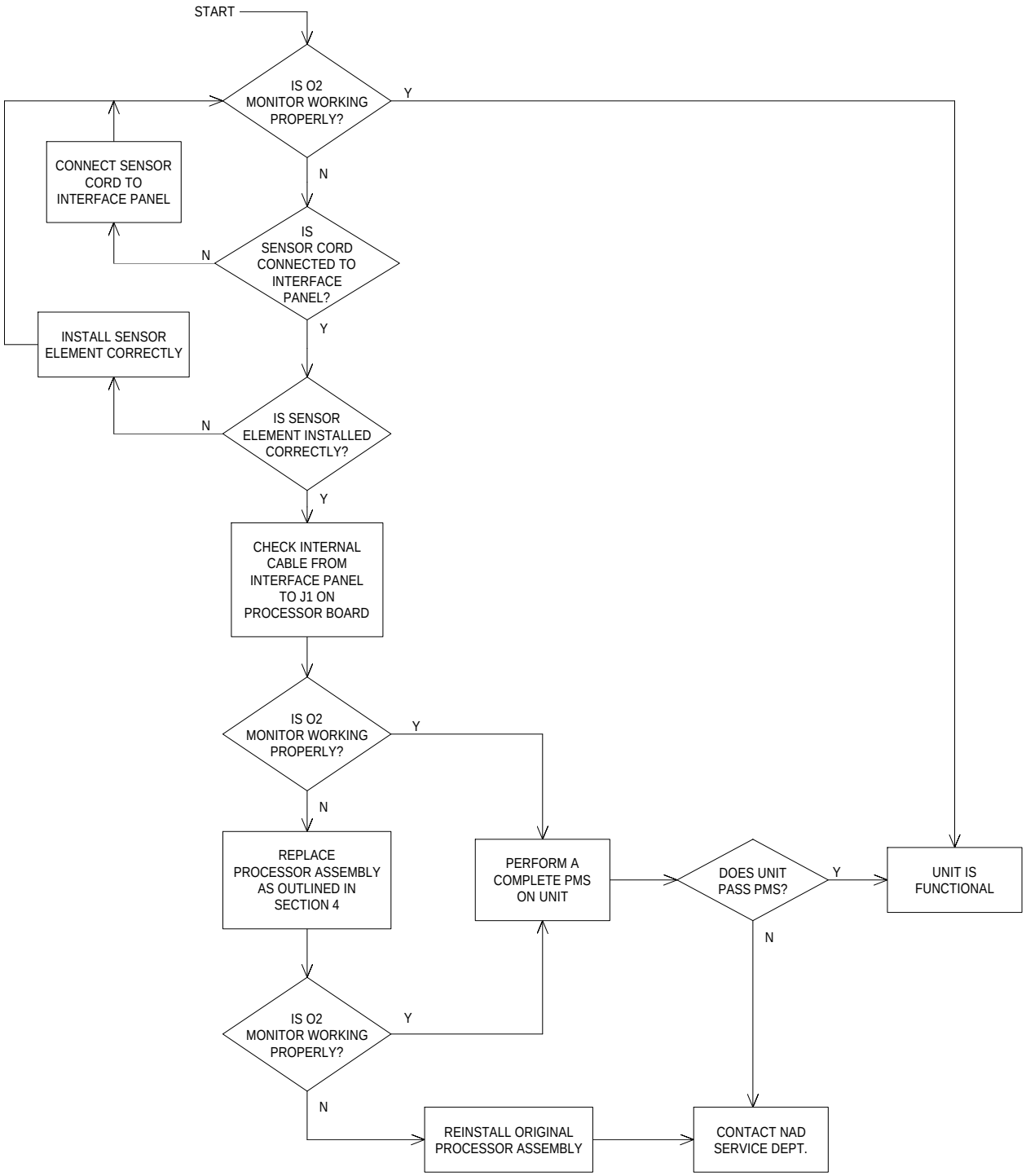
3.3 Troubleshooting Guides

Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the monitoring and display devices in the NARKOMED 2C. Each failure mode or symptom is keyed to a troubleshooting guide flow chart at the back of this section to assist the TSR in locating a problem. These flow charts assume that the machine is plugged into an AC outlet with the correct voltage, and the machine is not running on its backup battery.

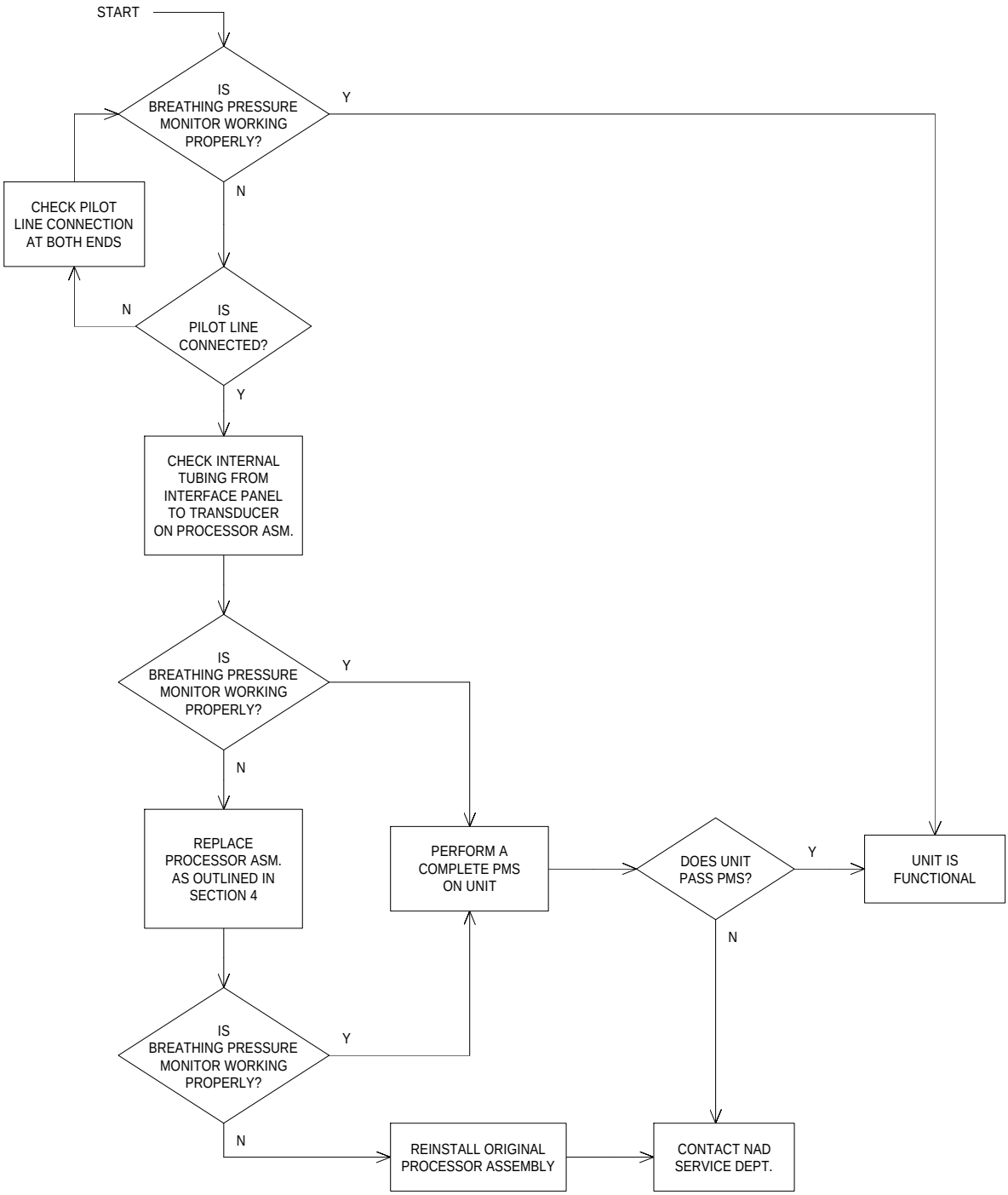
TABLE 3-2: NARKOMED 2C FAILURE MODE AND SYMPTOM LIST

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Loss of O_2 Monitor	Guide 1
Loss of Breathing Pressure Monitor	Guide 2
Loss of Respiratory Volume Monitor	Guide 3
No Audio Alarms	Guide 4
Serial Port Communication Failure	Guide 5
No Oxygen Supply Pressure Alarms	Guide 6
Display Blank Upon System Power-up	Guide 7
Display Keypanel Inoperative	Guide 8
No Datagrip Response	Guide 9
Ventilator Inoperative	Guide 10

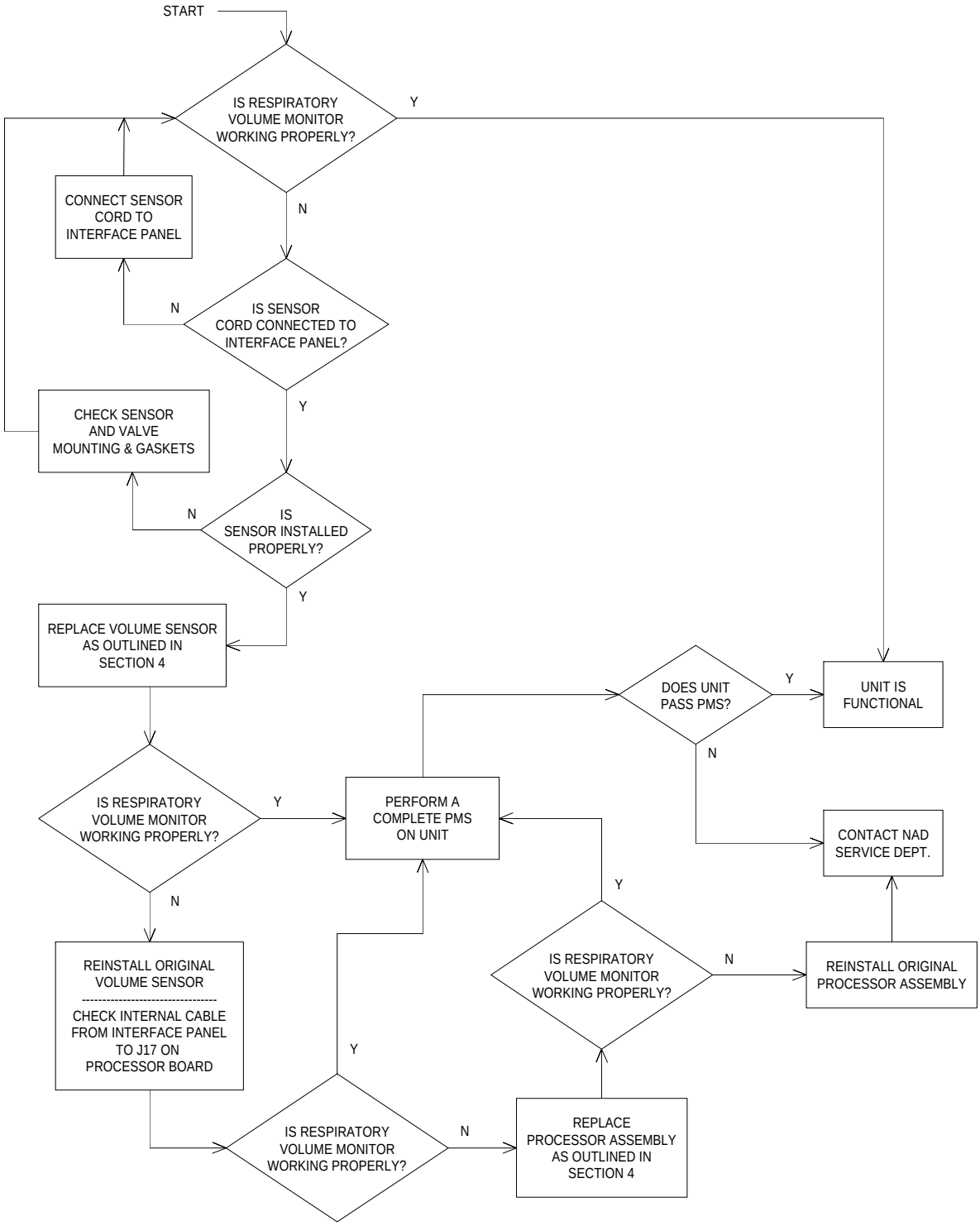
GUIDE 1: Loss of O_2 Monitor



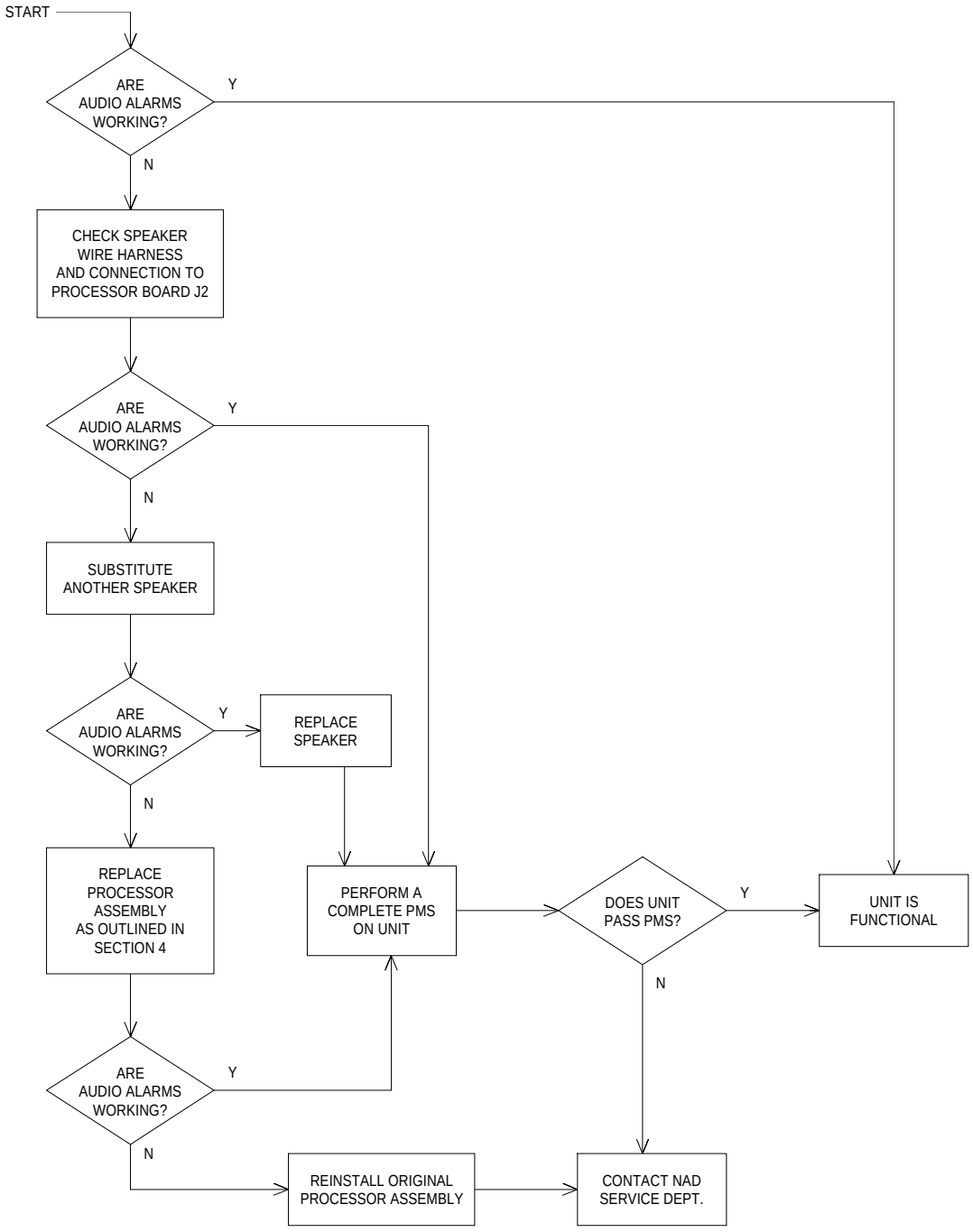
GUIDE 2: Loss of Breathing Pressure Monitor



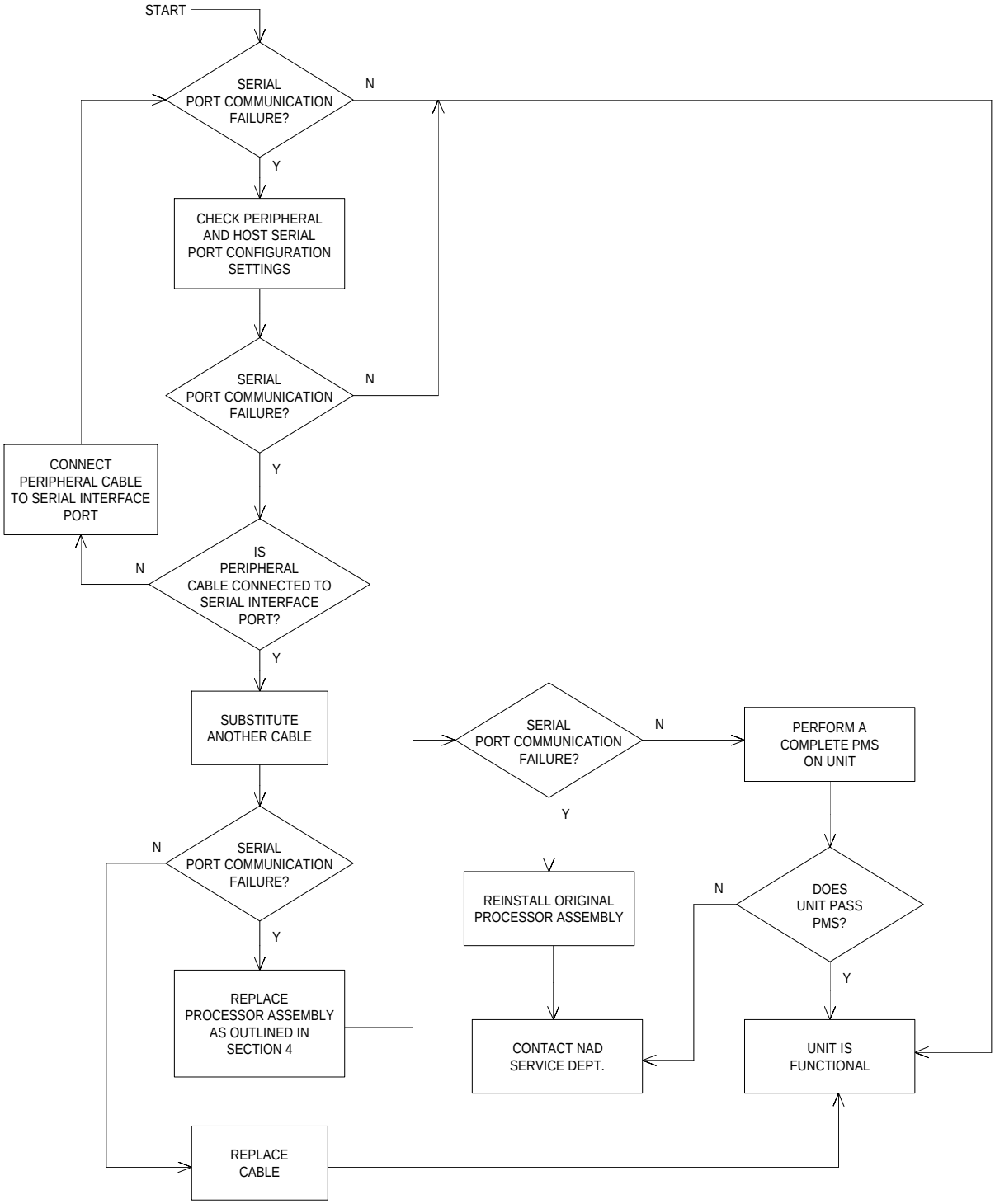
GUIDE 3: Loss of Respiratory Volume Monitor



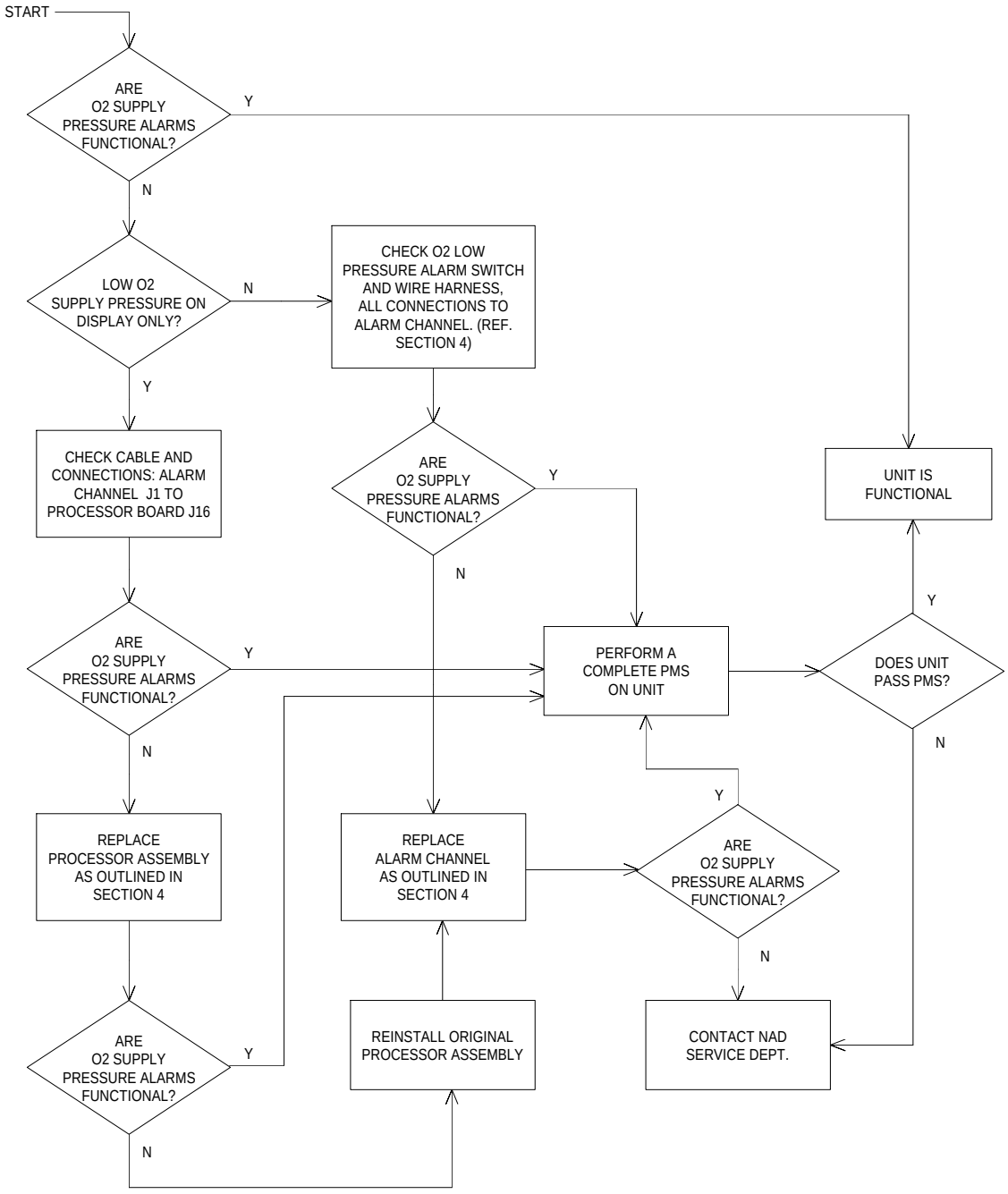
GUIDE 4: No Audio Alarms



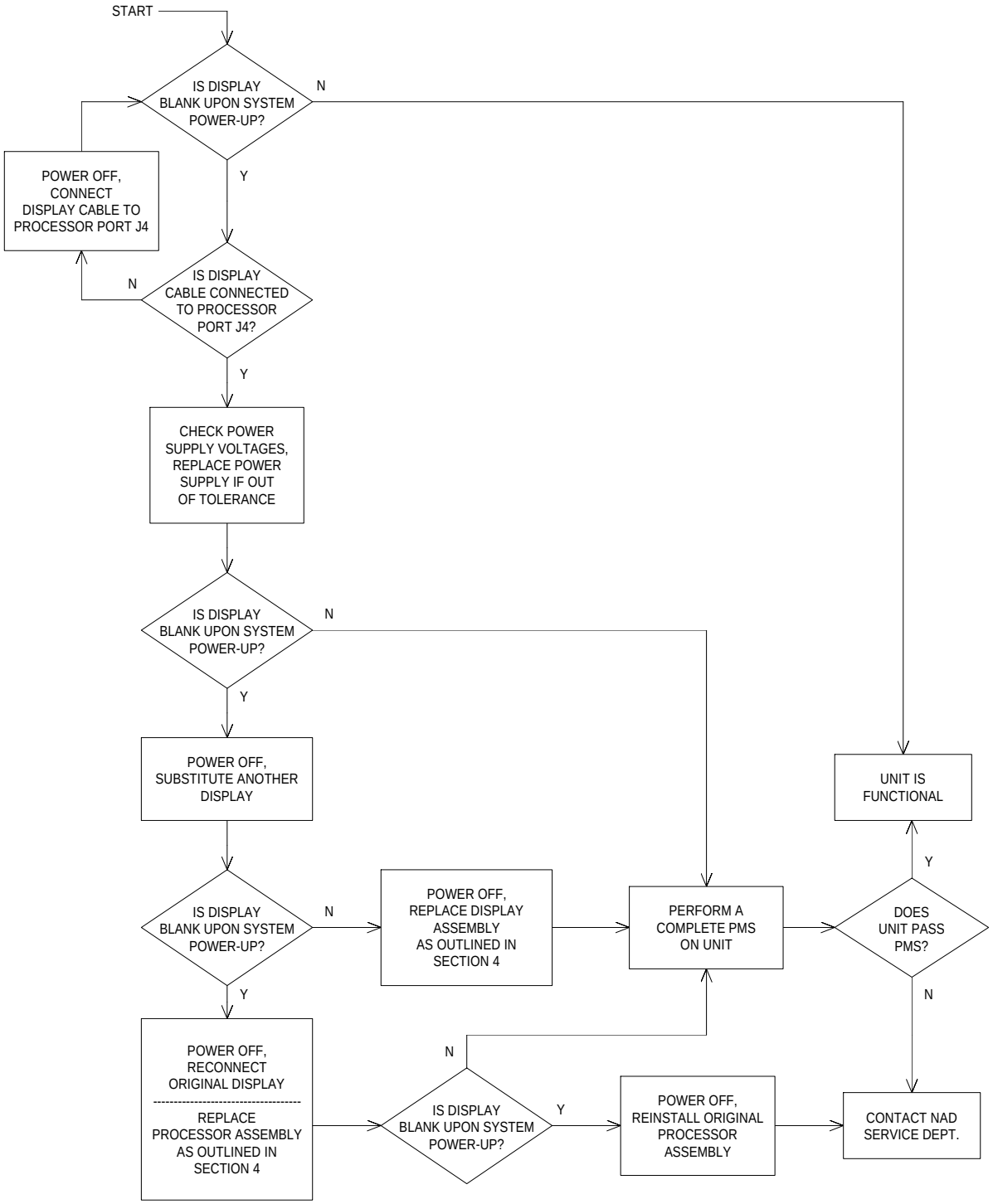
GUIDE 5: Serial Port Communication Failure



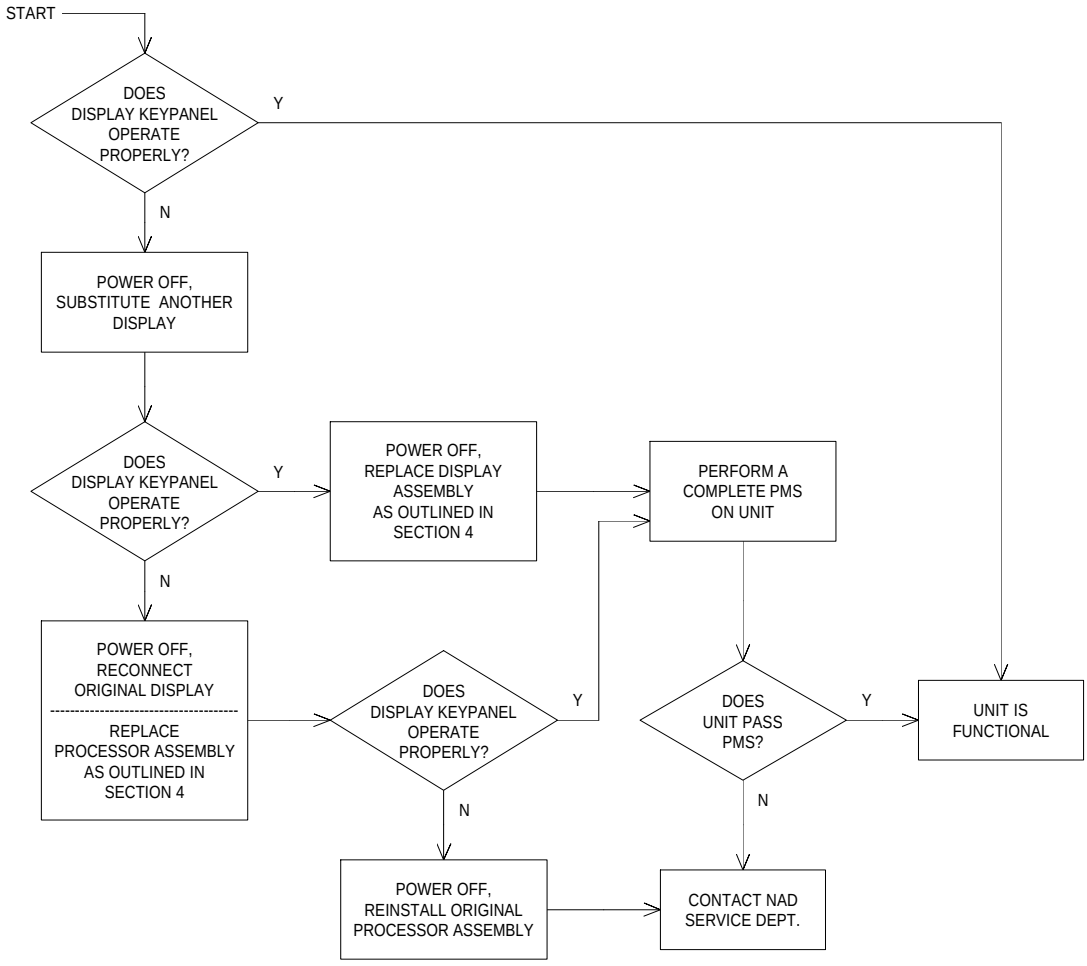
GUIDE 6: No O_2 Supply Pressure Alarms



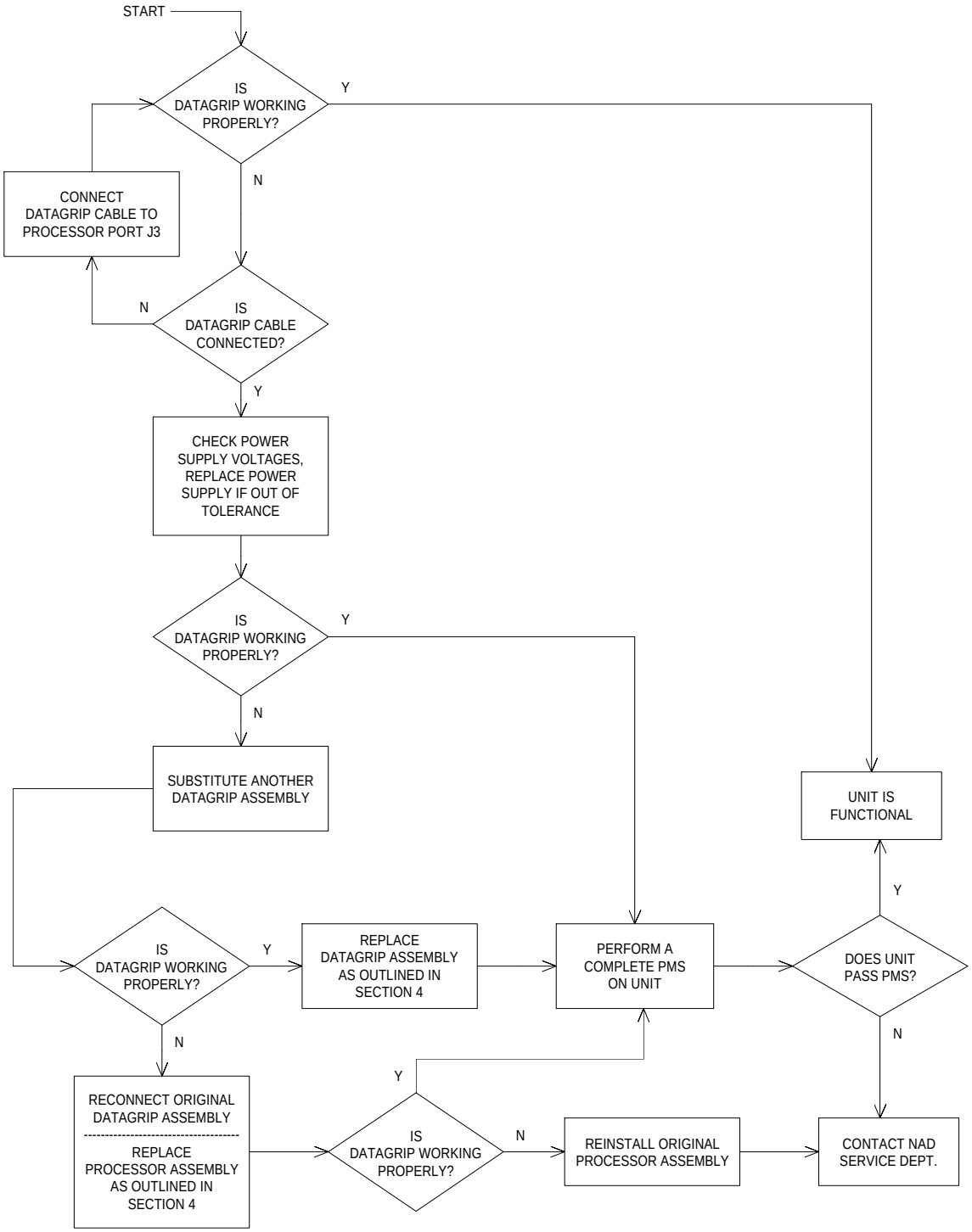
GUIDE 7: Display Blank Upon System Power-up


START
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
Y
POWER OFF, CONNECT DISPLAY CABLE TO PROCESSOR PORT J4
N
IS DISPLAY CABLE CONNECTED TO PROCESSOR PORT J4?
Y
CHECK POWER SUPPLY VOLTAGES, REPLACE POWER SUPPLY IF OUT OF TOLERANCE
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
Y
POWER OFF, SUBSTITUTE ANOTHER DISPLAY
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
POWER OFF, REPLACE DISPLAY ASSEMBLY AS OUTLINED IN SECTION 4
Y
POWER OFF, RECONNECT ORIGINAL DISPLAY
REPLACE PROCESSOR ASSEMBLY AS OUTLINED IN SECTION 4
N
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
Y
POWER OFF, REINSTALL ORIGINAL PROCESSOR ASSEMBLY
CONTACT NAD SERVICE DEPT.
PERFORM A COMPLETE PMS ON UNIT
DOES UNIT PASS PMS?
Y
N
UNIT IS FUNCTIONAL

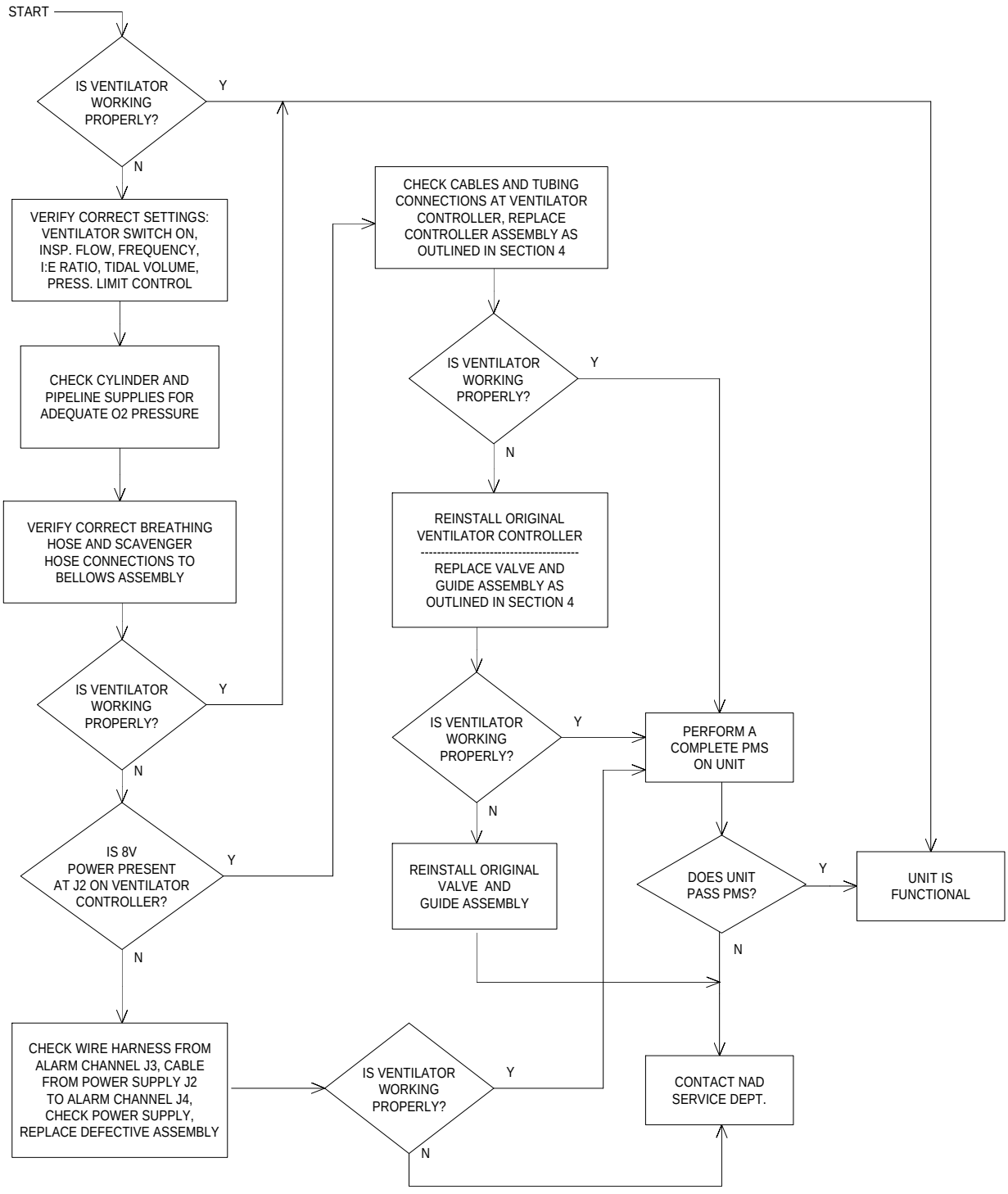
GUIDE 8: Display Keypanel Inoperative



GUIDE 9: No Datagrip Response



GUIDE 10: Ventilator Inoperative


START
IS VENTILATOR WORKING PROPERLY?
Y
N
VERIFY CORRECT SETTINGS: VENTILATOR SWITCH ON, INSP. FLOW, FREQUENCY, I:E RATIO, TIDAL VOLUME, PRESS. LIMIT CONTROL
CHECK CYLINDER AND PIPELINE SUPPLIES FOR ADEQUATE O2 PRESSURE
VERIFY CORRECT BREATHING HOSE AND SCAVENGER HOSE CONNECTIONS TO BELLOWS ASSEMBLY
IS VENTILATOR WORKING PROPERLY?
Y
N
IS 8V POWER PRESENT AT J2 ON VENTILATOR CONTROLLER?
Y
N
CHECK WIRE HARNESS FROM ALARM CHANNEL J3, CABLE FROM POWER SUPPLY J2 TO ALARM CHANNEL J4, CHECK POWER SUPPLY, REPLACE DEFECTIVE ASSEMBLY
IS VENTILATOR WORKING PROPERLY?
Y
N
CHECK CABLES AND TUBING CONNECTIONS AT VENTILATOR CONTROLLER, REPLACE CONTROLLER ASSEMBLY AS OUTLINED IN SECTION 4
IS VENTILATOR WORKING PROPERLY?
Y
N
REINSTALL ORIGINAL VENTILATOR CONTROLLER
REPLACE VALVE AND GUIDE ASSEMBLY AS OUTLINED IN SECTION 4
IS VENTILATOR WORKING PROPERLY?
Y
N
REINSTALL ORIGINAL VALVE AND GUIDE ASSEMBLY
PERFORM A COMPLETE PMS ON UNIT
DOES UNIT PASS PMS?
Y
N
UNIT IS FUNCTIONAL
CONTACT NAD SERVICE DEPT.

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4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the NARKOMED 2C Anesthesia System.

These procedures are to be performed only by a Draeger Medical, Inc. qualified Technical Service Representative (TSR).

The following are the only procedures authorized by Draeger Medical, Inc. to be performed in the field. All other service procedures shall be referred to Draeger Medical, Inc.'s Technical Service Department.

NOTE: **The PMS PROCEDURE given in Section 6 must be performed after any replacement, removal, calibration or adjustment procedure.**

4.1 Cylinder Yoke Assemblies

Each cylinder yoke contains a replaceable filter and check valve assembly. Replacement of this assembly requires that the yoke be removed from the anesthesia machine. Figure 4-1 shows a typical cylinder yoke mounting arrangement. Access to the yoke mounting screws and gas line connection requires that the table top be removed from the machine.

4.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.1.2 Close all cylinder valves except the O_2 valve.

4.1.3 Set the oxygen flow to 5 liters per min.

4.1.4 Open the other gas flow control valves to drain pressure from the system.

4.1.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.1.6 Set the System Power switch to STANDBY.

4.1.7 Remove the cylinder where the yoke is to be replaced.

WARNING: Store the cylinder in a safe place and lay it on its side.

4.1.8 Remove the screws holding the table top to the machine and lift out the table top.

4.1.9 Pull the writing or keyboard tray out to its fully extended position.

4.1.10 Disconnect the gas line fitting at the yoke and remove the two yoke mounting screws.

4.1.11 Remove the filter and check valve assembly from the yoke and install a replacement assembly.

NOTE: If the entire yoke assembly is being replaced, verify that the pin indexing arrangement and the label are in agreement with the gas designation stamped on the mounting surface of the yoke. Refer to the parts list in Section 8.

NOTE: If the yoke spacer is removed from the frame rail of the machine, be sure to re-install it in its original position.

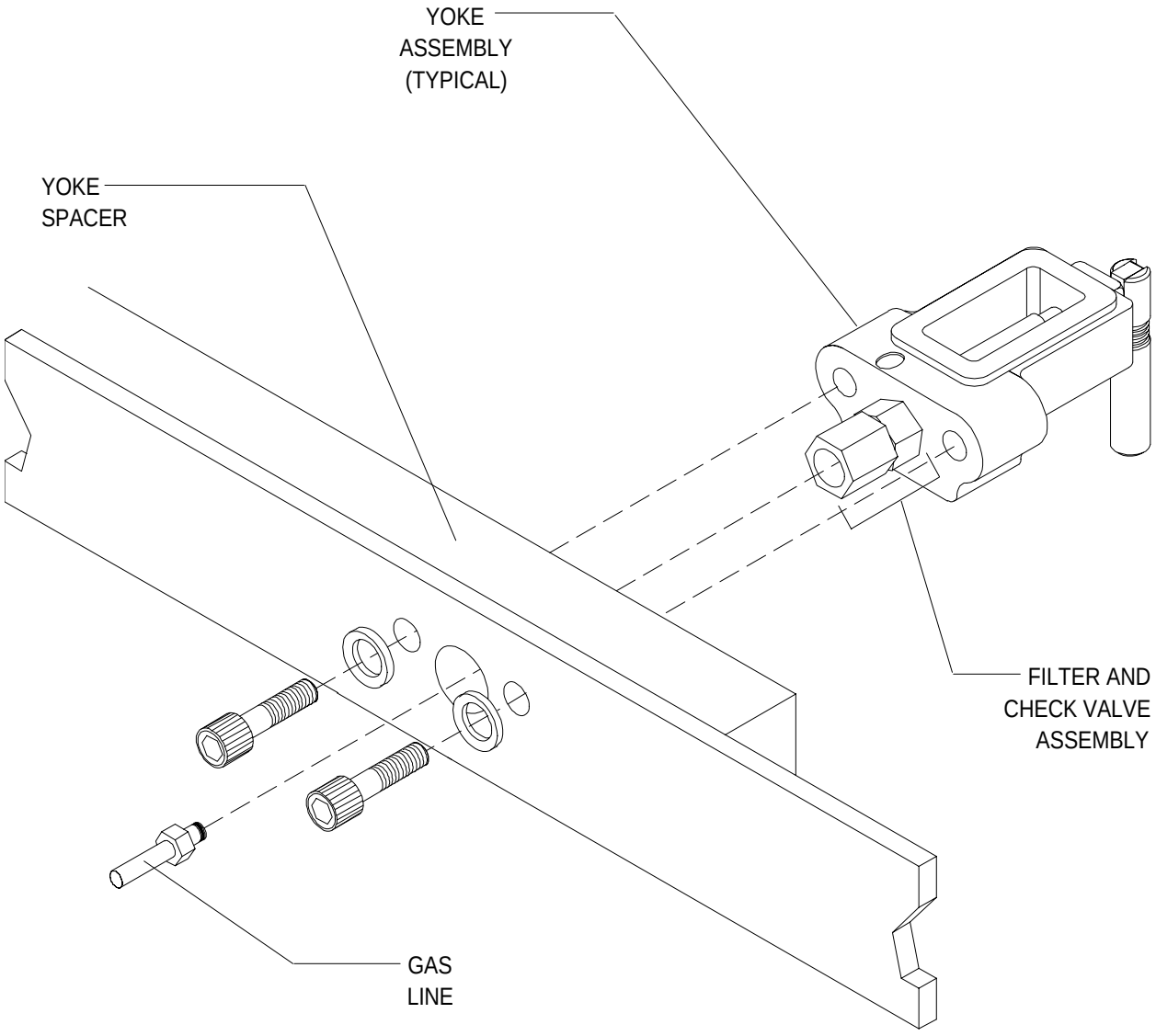

Figure 4-1: CYLINDER YOKE ASSEMBLY

4.1.12 Position the yoke on the spacer, and install the two mounting screws and lockwashers. Tighten the screws securely. Connect the gas line fitting to the yoke.

4.1.13 If a new cylinder is being installed, remove the old sealing washer from the gas inlet of the yoke and install a new washer.

4.1.14 Install the correct cylinder in the yoke, making sure that the index pins are properly engaged before tightening the handle bolt. The cylinder should hang vertically after the handle is tight.

4.1.15 Perform the following leak test on the yoke assembly:

4.1.15.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2	: 1000 Psi
N_2O	: 700 Psi
HE	: 1000 Psi
CO_2	: 800 Psi
AIR	: 1000 Psi
N_2	: 1000 Psi

4.1.15.2 Close the cylinder valve and remove the cylinder from the yoke.

4.1.15.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.1.16 Re-install the cylinder in the yoke.

4.1.17 Replace the table top and its retaining screws.

4.1.18 Replace the pipeline hoses.

4.1.19 Perform the PMS Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

Access to the cylinder pressure regulators requires that the table top be removed from the anesthesia machine. Figure 4-2 shows the mounting arrangement of the regulators and typical connections.

4.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.2.2 Close all cylinder valves except the O_2 valve.

4.2.3 Set the oxygen flow to 5 liters per min.

4.2.4 Open the other gas flow control valves to drain pressure from the system.

4.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.2.6 Set the System Power switch to STANDBY.

4.2.7 Remove the cylinder corresponding to the regulator to be replaced.

4.2.8 Remove the screws holding the table top to the machine and lift out the table top.

4.2.9 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.2.10 Disconnect the three compression fittings at the regulator.

4.2.11 Loosen the two setscrews holding the regulator to its mounting bracket and remove the regulator.

4.2.12 Record the serial number of the regulator that was removed, and record the serial number of the replacement regulator.

NOTE: If fittings must be installed in the replacement regulator, use Loctite #271 (red). Refer to the parts list in Section 8.

NOTE: For Canadian machines, verify that the correct relief valve is installed in the regulator. Refer to the parts list in Section 8 for CSA items.

4.2.13 Position the replacement regulator in its mounting bracket, and connect the three compression fittings. Do not tighten the fittings yet.

TOP VIEW OF NARKOMED 4
WITH TABLE TOP REMOVED

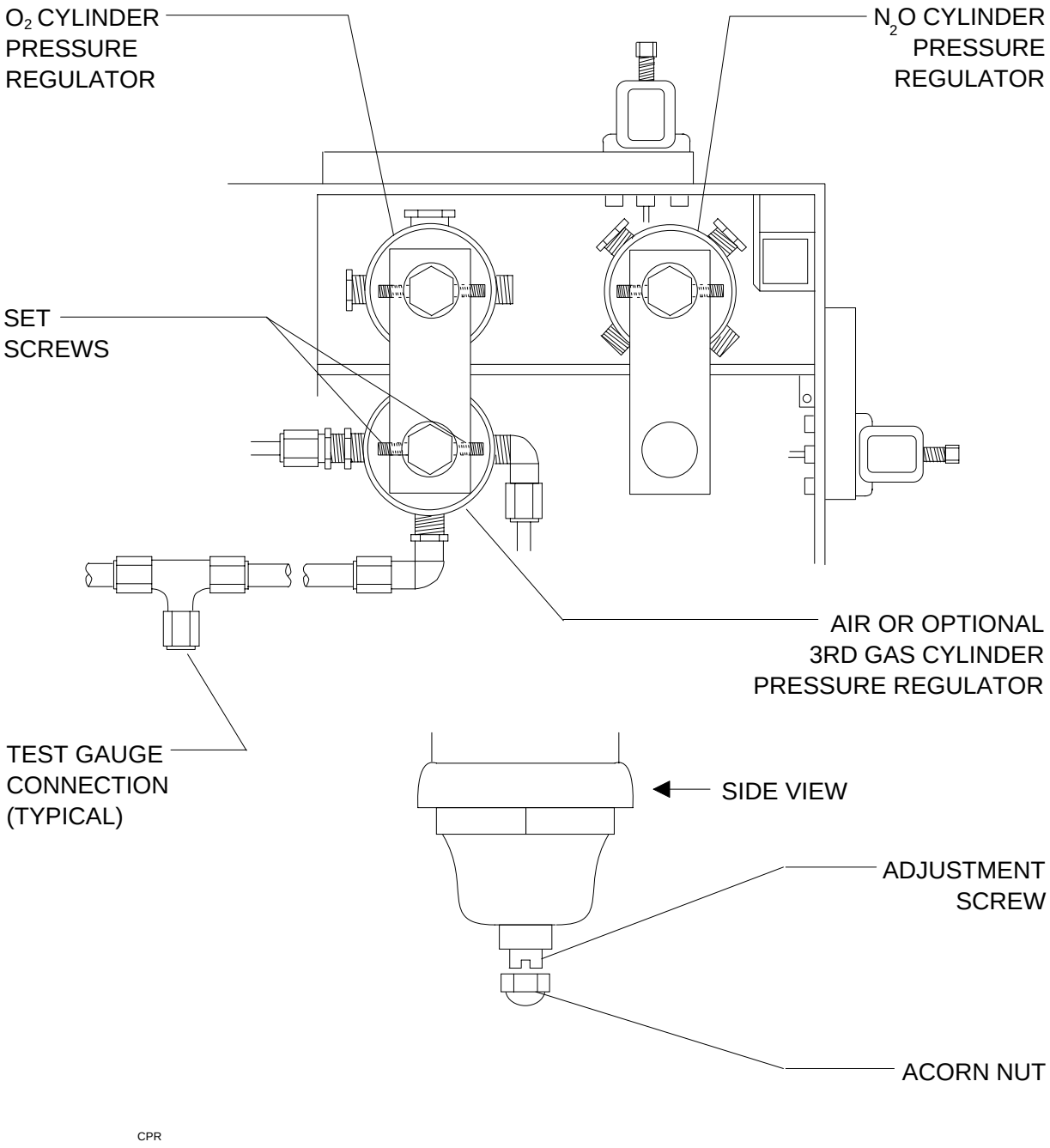

Figure 4-2: CYLINDER PRESSURE REGULATORS

4.2.14 Tighten the regulator mounting setscrews to a torque of 50 to 55 in. lbs.

4.2.15 Tighten the compression fittings.

4.2.16 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

4.2.17 Set the regulator output pressure in accordance with the Cylinder Pressure Regulator Adjustment given in Section 5.

4.2.18 Perform the following leak test on the high pressure side of the regulator:

4.2.18.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 Psi
N_2O : 700 Psi
HE : 1000 Psi
CO_2 : 800 Psi
AIR : 1000 Psi
N_2 : 1000 Psi

4.2.18.2 Close the cylinder valve and remove the cylinder from the yoke.

4.2.18.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.2.19 Re-install the cylinder in the yoke.

4.2.20 Replace the table top and its retaining screws.

4.2.21 Replace the top drawer in the cabinet.

4.2.22 Connect the pipeline hoses.

4.2.23 Perform the PMS Procedure given in Section 6.

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4.3 Cylinder Cutoff Valves (Canada)

Access to the cylinder cutoff valves requires removal of the table top from the anesthesia machine. Figure 4-3 shows the locations of the O_2, Air or 3rd gas, and N_2O cutoff valve assemblies. The instructions apply to all three assemblies. On earlier machines the tubing arrangement may be slightly different from that illustrated.

NOTE: Replacement of the O_2 Cutoff Valve Assembly shall be performed every 24 months. Documentation shall be created by the service person and a copy distributed to the owner institution. Testing of the O_2 Cutoff Valve shall be performed at each PMS. (Perform the flow test given at the end of the following procedure)

4.3.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.3.2 Close all cylinder valves except the O_2 valve.

4.3.3 Set the oxygen flow to 5 liters per min.

4.3.4 Open the other gas flow control valves to drain pressure from the system.

4.3.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.3.6 Set the System Power switch to STANDBY.

4.3.7 Remove the screws holding the table top to the machine and lift out the table top.

4.3.8 Remove the top drawer from the cabinet and pull the writing or keyboard tray out to its fully extended position.

4.3.9 Disconnect the compression fittings indicated at points marked C on the illustration.

4.3.10 Cut the tie-wrap clamp and disconnect the flexible tubing from the cutoff valve assembly at the point marked A on the illustration.

NOTE: On later machines with assemblies that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

4.3.11 Remove the cylinder cutoff assembly.

4.3.12 Connect the flexible tubing to the replacement cutoff valve assembly and secure it with a new tie-wrap clamp.

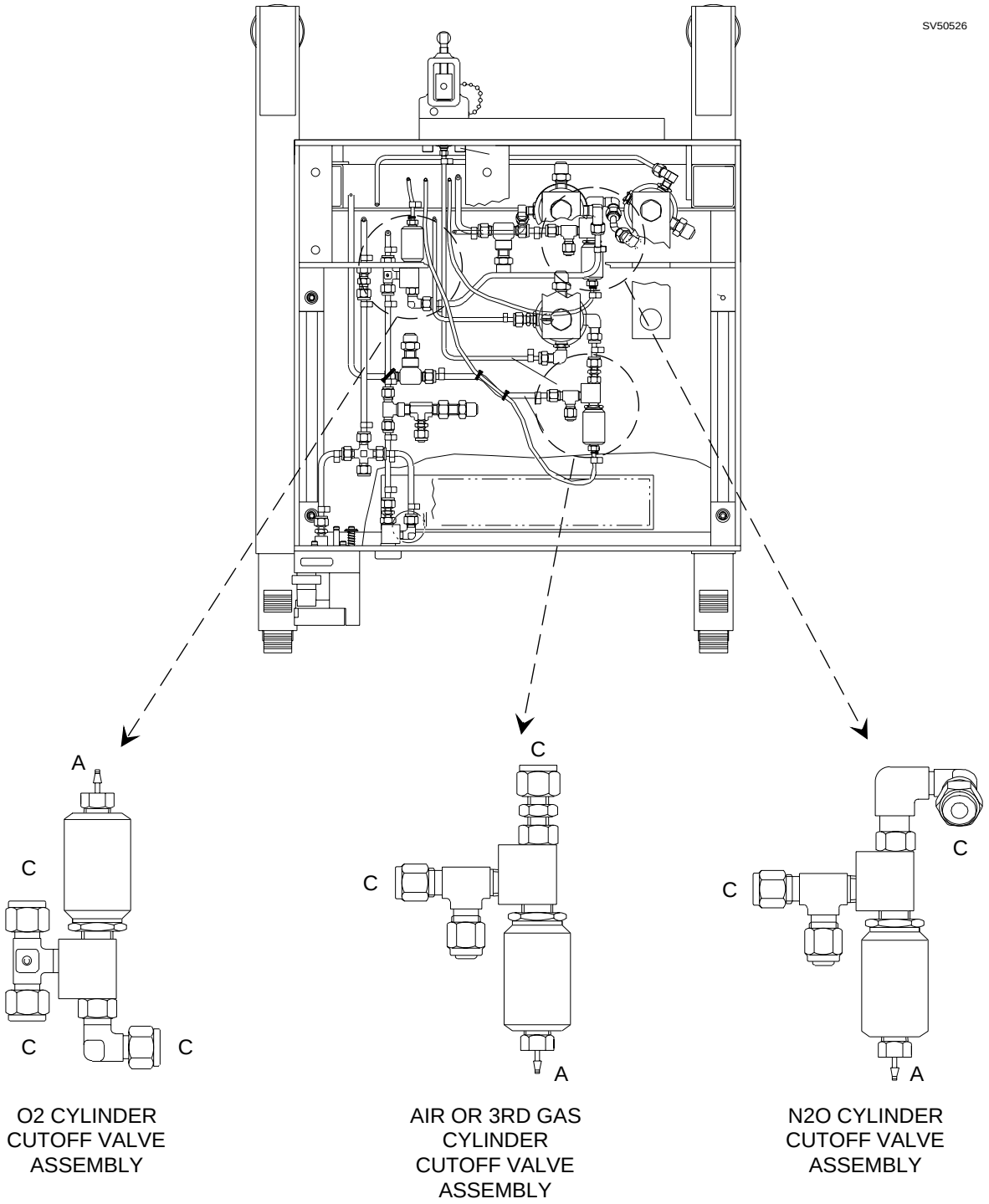

Figure 4-3: CYLINDER CUTOFF VALVES (CANADA)

4.3.13 Connect and tighten the compression fittings at points marked C on the illustration.

4.3.14 Perform the following test: --Remove the plug from the test gauge connection at the Tee fitting in the regulator outlet piping, and install a test gauge.

NOTE: The cylinders used for this test must contain the following minimum pressure: O_2 : 1000 PSI AIR : 1000 PSI
O_2+He : 1000 PSI N_2O : 745 PSI

--Set the System Power switch to ON.
--For the O_2 cutoff valve: open the O_2 cylinder valve and set the oxygen flow to 4 liters per min.
--For the N_2O cutoff valve: open the O_2 cylinder valve and the N_2O cylinder valve. Set each flow to 4 liters per min.
--Verify that regulator outlet pressure is between 43 and 49 PSI.
--Connect the pipeline hoses and pressurize to 50 PSI.
--Turn off the pipeline supply and observe the pipeline pressure gauge.
--The cutoff valve shall open when the pipeline pressure drops through the range of 45 to 40 PSI.
--Close the cylinder valve(s), and close the flow control valve(s).
--Disconnect test pressure gauge and reinstall the plug in the regulator outlet piping.

4.3.15 Replace the table top and its retaining screws.

4.3.16 Replace the top drawer in the cabinet.

4.3.17 Connect the pipeline hoses.

4.3.18 Perform the PMS Procedure given in Section 6.

O_2 Flow Test:

--Disconnect all pipeline supplies.
--Install a full O_2 cylinder on the machine, and open the cylinder valve.
--Turn the System Power switch to ON.
--Set the Inspiratory Flow control to maximum high, and turn the ventilator switch to ON.
--Set the oxygen flow to 10 l/min.
--Verify that the oxygen flow does not drop below 8 l/min. while the ventilator is running.
--Press and hold the O_2 FLUSH button while observing the O_2 flowmeter, and verify that the oxygen flow does not drop below 8 l/min.
--If the oxygen flow in either of the above two steps drops below 8 l/min., replace the O_2 cutoff valve assembly.

4.4 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires that the plexiglass front cover be removed from the gas instrumentation panel, and also the rear cover for access to the gauge connections. Figure 4-4 shows gauge mounting and connection details.

4.4.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.4.2 Close all cylinder valves except the O_2 valve.

4.4.3 Set the oxygen flow to 5 liters per min.

4.4.4 Open the other gas flow control valves to drain pressure from the system.

4.4.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.4.6 Set the System Power switch to STANDBY.

4.4.7 Remove the screws holding the rear cover, and remove the cover.

4.4.8 Remove the screws holding the table top to the machine and lift out the table top.

4.4.9 Remove the six screws holding the flowmeter shield and vapor box front cover panel, and pull the panel forward approximately ½ inch.

4.4.10 Remove the oxygen flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.4.11 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.4.12 Carefully remove the plexiglass cover from the front of the flowmeter housing.

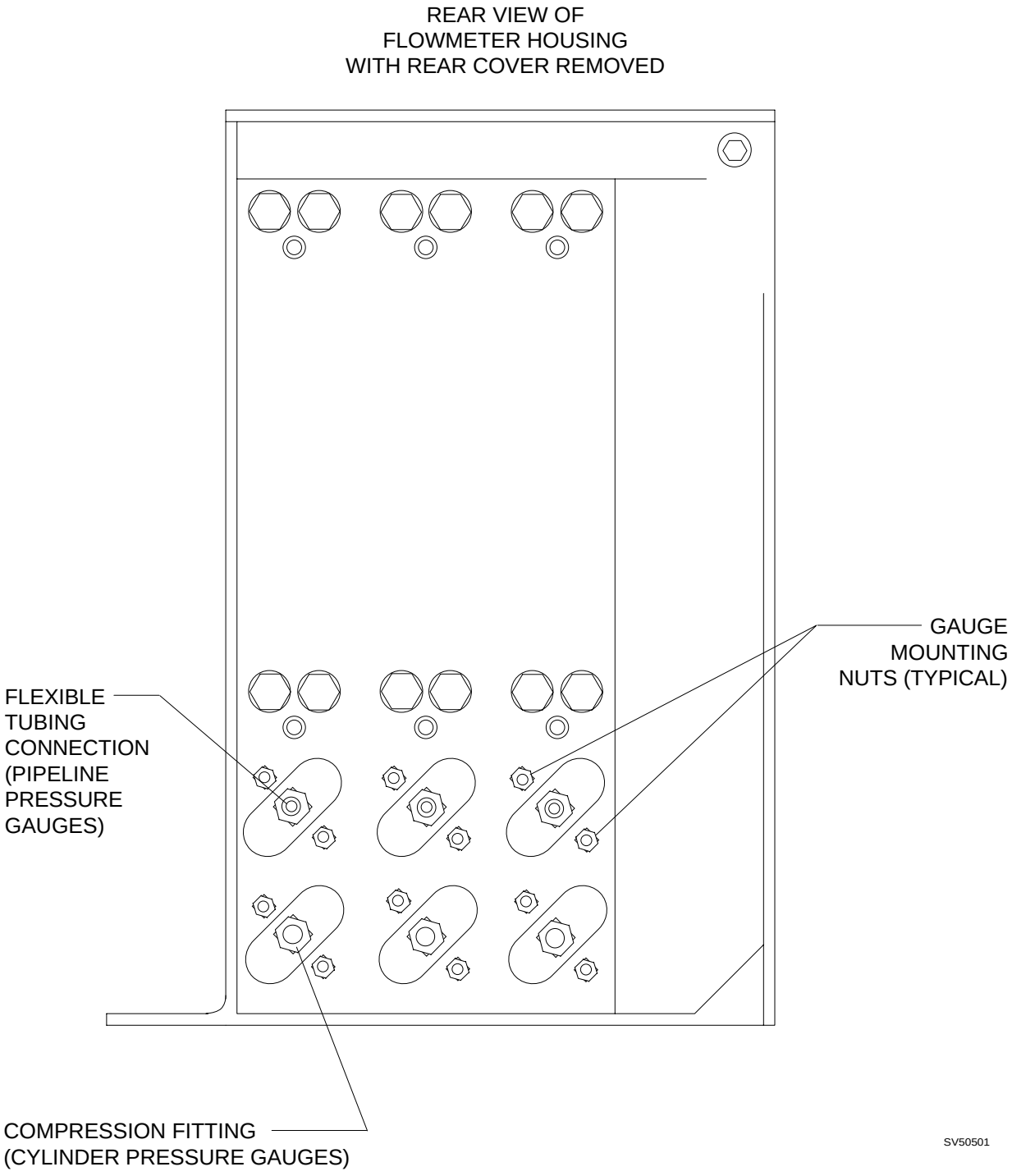

Figure 4-4: CYLINDER AND PIPELINE PRESSURE GAUGES

NOTE: Intermediate assemblies may need to be removed to allow access to the gauge connections and mounting hardware. Be sure to keep a record of the disassembly sequence so that all tubing can be correctly re-assembled.

4.4.13A For the cylinder pressure gauges:

Disconnect the compression fitting at the back of the gauge.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Install the replacement gauge in the panel using the flat washers, lock washers and mounting nuts that were previously removed.

Connect the gas line to the gauge and tighten the compression fitting.

4.3.13B For the pipeline pressure gauges:

Locate the flexible tubing connecting the gauge to the pipeline inlet assembly, cut the tie-wrap tubing clamp at the pipeline inlet and disconnect the tubing.

NOTE: On later machines that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Cut the tie-wrap tubing clamp and disconnect the flexible tubing from the gauge.

Connect a new 7-inch length of tubing (8-inch for the air pipeline pressure gauge) to the replacement gauge and secure it with a new tie-wrap clamp.

Place the gauge in the panel and secure it with the flat washers, lock washers and mounting nuts that were previously removed.

Connect the other end of the flexible tubing to the pipeline inlet assembly and secure it with a tie-wrap clamp.

4.4.14 If a cylinder pressure gauge was replaced, perform the following leak test:

4.4.14.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 Psi
N_2O : 700 Psi
HE : 1000 Psi
CO_2 : 800 Psi
AIR : 1000 Psi
N_2 : 1000 Psi

4.4.14.2 Close the cylinder valve and remove the cylinder from the yoke.

4.4.14.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.4.15 Re-install the cylinder in the yoke.

4.4.16 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.4.17 Place the knob guard over the flow control valves and install its two retaining screws.

4.4.18 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

4.4.19 Replace the front plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.4.20 Replace the rear cover and its retaining screws.

4.4.21 Replace the table top and its retaining screws.

4.4.22 Connect the pipeline hoses.

4.4.23 Perform the PMS Procedure given in Section 6.

4.5 Flowmeters

The flowmeter tubes are held by compression in gaskets at the top and bottom of each tube. Each upper gasket is seated in an adjustable retainer that allows removal of the tube as shown in Figure 4-5. Access to the flow tubes and their retainers requires removal of the plexiglass cover on the gas instrumentation panel.

4.5.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.5.2 Close all cylinder valves except the O_2 valve.

4.5.3 Set the oxygen flow to 5 liters per min.

4.5.4 Open the other gas flow control valves to drain pressure from the system.

4.5.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.5.6 Set the System Power switch to STANDBY.

4.5.7 Remove the screws holding the table top to the machine and lift out the table top.

4.5.8 Remove the six screws holding the flowmeter shield and vapor box front cover panel, and pull the panel forward approximately ½ inch.

4.5.9 Remove the oxygen flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.5.10 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.5.11 Carefully remove the plexiglass cover from the front of the flowmeter housing.

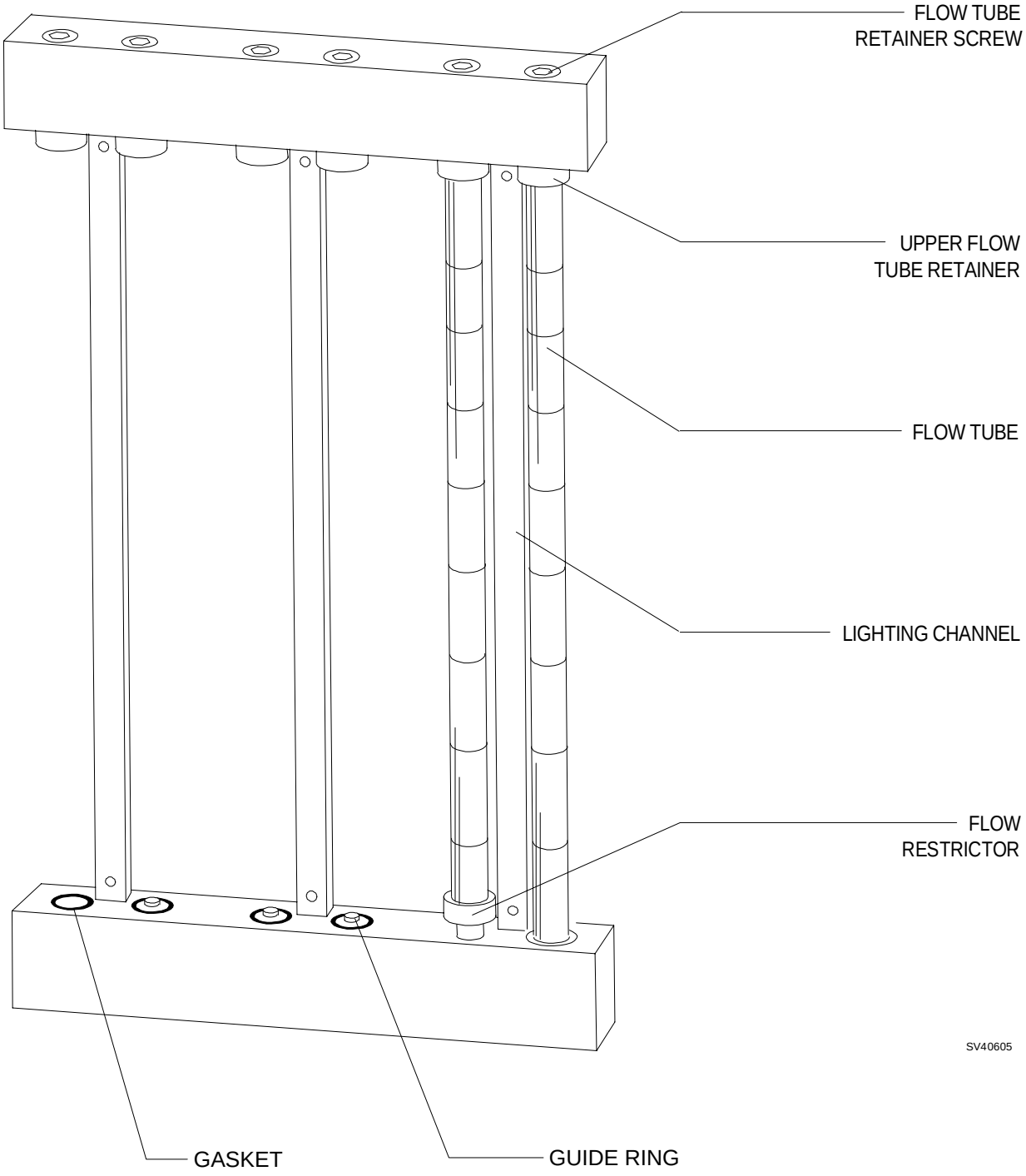

Figure 4-5: FLOWMETERS

4.5.12 Loosen the screw directly above the flowmeter tube to be replaced. Turning the screw counter clockwise will raise the upper flow tube retainer. Raise the retainer far enough to be able to pull the top of the tube outward, and remove the tube.

NOTE: If the bottom of the tube is seated in a flow restrictor, be sure that the arrangement of the restrictor and its gaskets is not disturbed.

4.5.13 Make sure that the replacement flow tube bears the correct markings and has a ball.

4.5.14 Place the bottom of the flowmeter tube into the guide ring of the lower gasket seal, and position the top of the flow tube into the center guide ring of the top gasket seal. It will be easier to hold the tube if the adjacent lighting channel is pulled forward and temporarily removed.

CAUTION: The flowmeter tube must be properly centered over the guide rings or damage to the flowmeter tube may occur.

4.5.15 Ensure that the markings on the flow tube are facing forward, and turn the upper retainer screw clockwise until the flow tube is firmly held in place.

CAUTION: Do not over-tighten the screw as the flowmeter tube may break.

4.5.16 Perform the following leak test on the system:

4.5.16.1 Disconnect the absorber hose from the fresh gas outlet.

4.5.16.2 Connect a test gauge and B.P. bulb to the fresh gas outlet, and pressurize the system to 50 cm H_2O.

4.5.16.3 The pressure should not drop more than 10 cm H_2O in thirty seconds.

4.5.17 Disconnect the test gauge and re-connect the absorber hose to the fresh gas outlet.

4.5.18 Replace any lighting channels that were previously removed.

4.5.19 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.5.20 Place the knob guard over the flow control valves and install its two retaining screws.

4.5.21 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

4.5.22 Replace the front plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.5.23 Replace the table top and its retaining screws.

4.5.24 Connect the pipeline hoses.

4.5.25 Perform the PMS Procedure given in Section 6.

4.6 Flow Control Valves

The flow control valves have replaceable elements that are removable from the front of the gas instrumentation panel as shown in Figure 4-6. Each flow control knob has a clockwise positive stop arrangement that prevents damage to the valve seat. Whenever a valve cartridge is replaced, the "off stop" must be set as outlined in the following procedure.

4.6.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.6.2 Close all cylinder valves except the O_2 valve.

4.6.3 Set the oxygen flow to 5 liters per min.

4.6.4 Open the other gas flow control valves to drain pressure from the system.

4.6.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.6.6 Set the System Power switch to STANDBY.

4.6.7 Remove the oxygen flow control knob.

4.6.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.6.9 Remove the knob (if not already removed) from the valve that is being replaced, and remove the stop pin nut.

4.6.10 Remove the flow control valve by holding it at the wrench flats and turning it counter-clockwise.

4.6.11 Install the replacement flow control valve in the valve body.

CAUTION: Before tightening the cartridge, rotate the valve shaft several turns counter-clockwise to prevent bottoming the valve element into the seat when the cartridge is tightened.

4.6.12 Replace the stop pin nut.

4.6.13 Replace the knob guard and secure it with the two mounting screws.

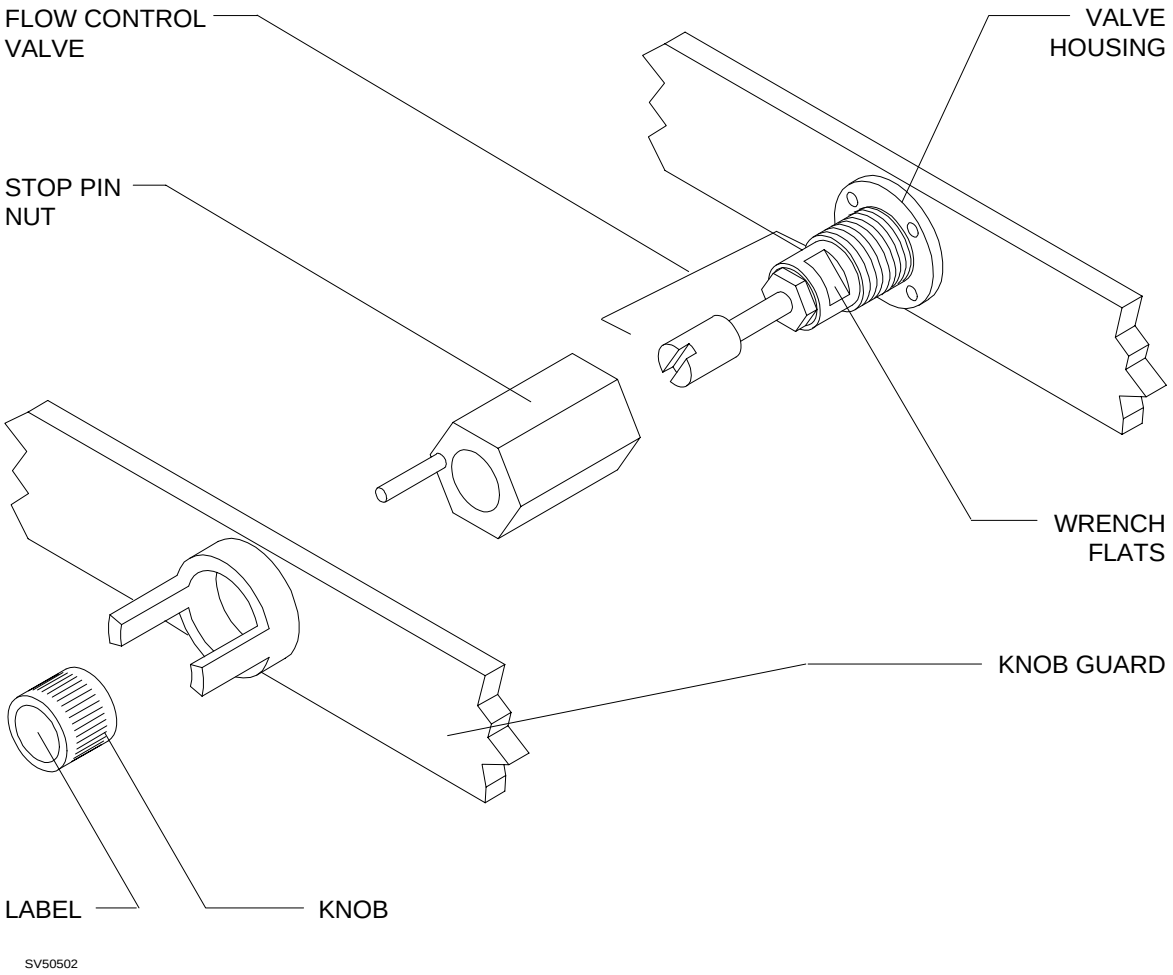

Figure 4-6: FLOW CONTROL VALVES

4.6.14 Set the System Power switch to ON.

4.6.15A For the O_2 flow control valve:

Open the oxygen cylinder valve.

Turn the flow control valve clockwise until the flow rate will not drop any further. (If the machine has been modified to eliminate the minimum flow feature, turn the valve until the flow rate is zero.)

4.6.15B For the other gas flow control valves:

Open the oxygen cylinder valve, and open the cylinder valve corresponding to the flow control valve replacement.

Set the oxygen flow rate to four liters per minute.

Turn the other gas flow control valve clockwise until the flow rate is zero.

4.6.16 Place the knob on the flow control valve shaft and turn it clockwise until it engages the stop pin. Tighten one of the knob setscrews.

4.6.17 Turn the knob in both directions and ensure that the flow can be controlled over its entire range. When the valve is closed, the knob should be against the clockwise stop. Tighten the remaining setscrew.

4.6.18 If the knob label is not horizontal when the valve is closed, remove the label and install a new label in the correct position.

4.6.19 Connect the pipeline hoses.

4.6.20 Perform the PMS Procedure given in Section 6.

4.7 Oxygen Supply Pressure Failure Protection Device

The oxygen supply failure protection devices (failsafe assemblies) are located within the flowmeter housing. Access to these assemblies requires removal of the rear cover. Figure 4-7 shows a typical arrangement of a failsafe assembly and its connections.

4.7.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.7.2 Close all cylinder valves except the O_2 valve.

4.7.3 Set the oxygen flow to 5 liters per min.

4.7.4 Open the other gas flow control valves to drain pressure from the system.

4.7.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.7.6 Set the System Power switch to STANDBY.

4.7.7 Remove the screws holding the rear cover, and remove the cover.

4.7.8 Cut the tie-wrap clamp on the flexible O_2 control line, and disconnect the flexible tube.

NOTE: On later machines with assemblies that have brass fittings instead of nylon, the flex tubing is attached with a press-on hose clamp instead of a tie strap.

4.7.9 Disconnect the compression fittings at the side ports and at the check valve, and remove the assembly.

NOTE: If fittings must be installed in the replacement block assembly, use Loctite #271 (red). See parts list in Section 8.

4.7.10 Install the replacement failsafe assembly, and tighten the three compression fittings.

4.7.11 Connect the flexible tubing to the control port, and install a new tie-wrap clamp.

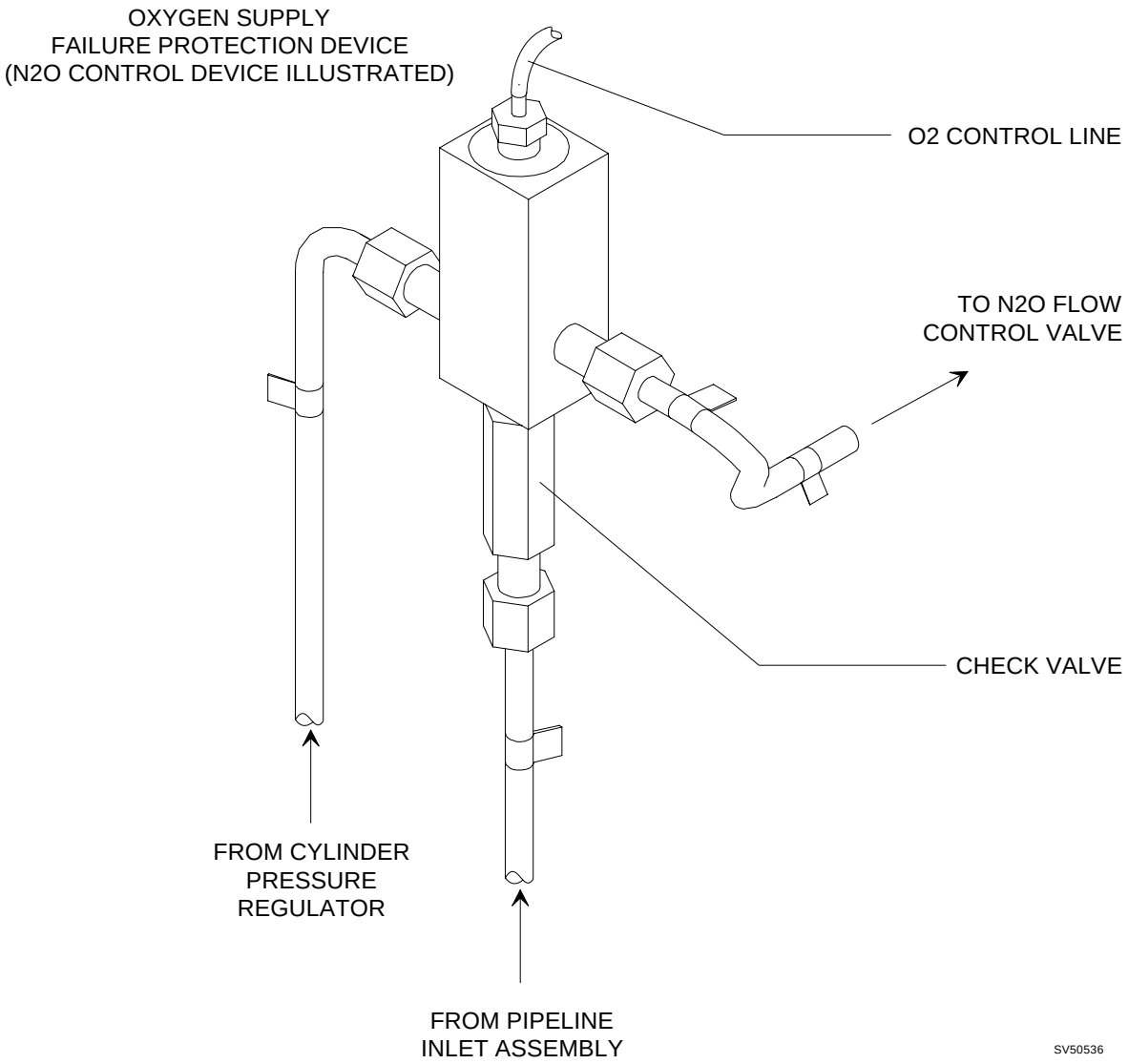

Figure 4-7: OXYGEN SUPPLY FAILURE PROTECTION DEVICE

4.7.12 Perform the following test:

4.7.12.1 Open the cylinder valves.

4.7.12.2 Set the System Power switch to ON.

4.7.12.3 Set the oxygen flow to five liters per minute.

4.7.12.4 Set the other gas flow to five liters per minute.

4.7.12.5 Close the oxygen cylinder valve.

4.7.12.6 As the oxygen flow decreases, the other gas flow should stop.

4.7.12.7 Set the System Power switch to STANDBY.

4.7.13 Replace the rear cover and its retaining screws.

4.7.14 Connect the pipeline hoses.

4.7.15 Perform the PMS Procedure given in Section 6.

4.8 Alarm Channel and Oxygen Supply Pressure Alarm Switch

The alarm channel assembly includes the oxygen supply pressure alarm switch, the alarm circuit board, and the system power switch. Whenever the alarm channel is replaced, the oxygen supply pressure alarm switch must be tested to ensure that its operating point is set correctly. Removal of the alarm channel requires removal of the upper flowmeter and vapor box cover plate, and removal of the flowmeter housing rear cover. The alarm channel assembly is held in place by two screws from the back. Figure 4-8 shows a rear view of the assembly and its connections.

4.8.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.8.2 Close all cylinder valves except the O_2 valve.

4.8.3 Set the oxygen flow to 5 liters per min.

4.8.4 Open the other gas flow control valves to drain pressure from the system.

4.8.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.8.6 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.8.7 Disable the circuit breakers on the power supply by pulling out each button with a knife or sharp object.

4.8.8 Remove the six screws holding the flowmeter shield and vapor box front coverpanel, and pull the panel forward approximately ½ inch.

4.8.9 Remove the screws holding the flowmeter housing rear cover, and remove the cover.

4.8.10 Remove the screws holding the table top, and lift out the table top.

4.8.11 Disconnect the cables from J1, J2, J3 and J4 on the alarm circuit board.

4.8.12 Disconnect the compression fitting on the O_2 line nearest to the oxygen supply pressure alarm switch.

4.8.13 Disconnect the remaining two O_2 lines at the top and bottom of the tee fitting.

4.8.14 If the machine is equipped with an auxiliary O_2 flowmeter, cut the tie strap on its flexible line and carefully remove the flex line from the hose barb.

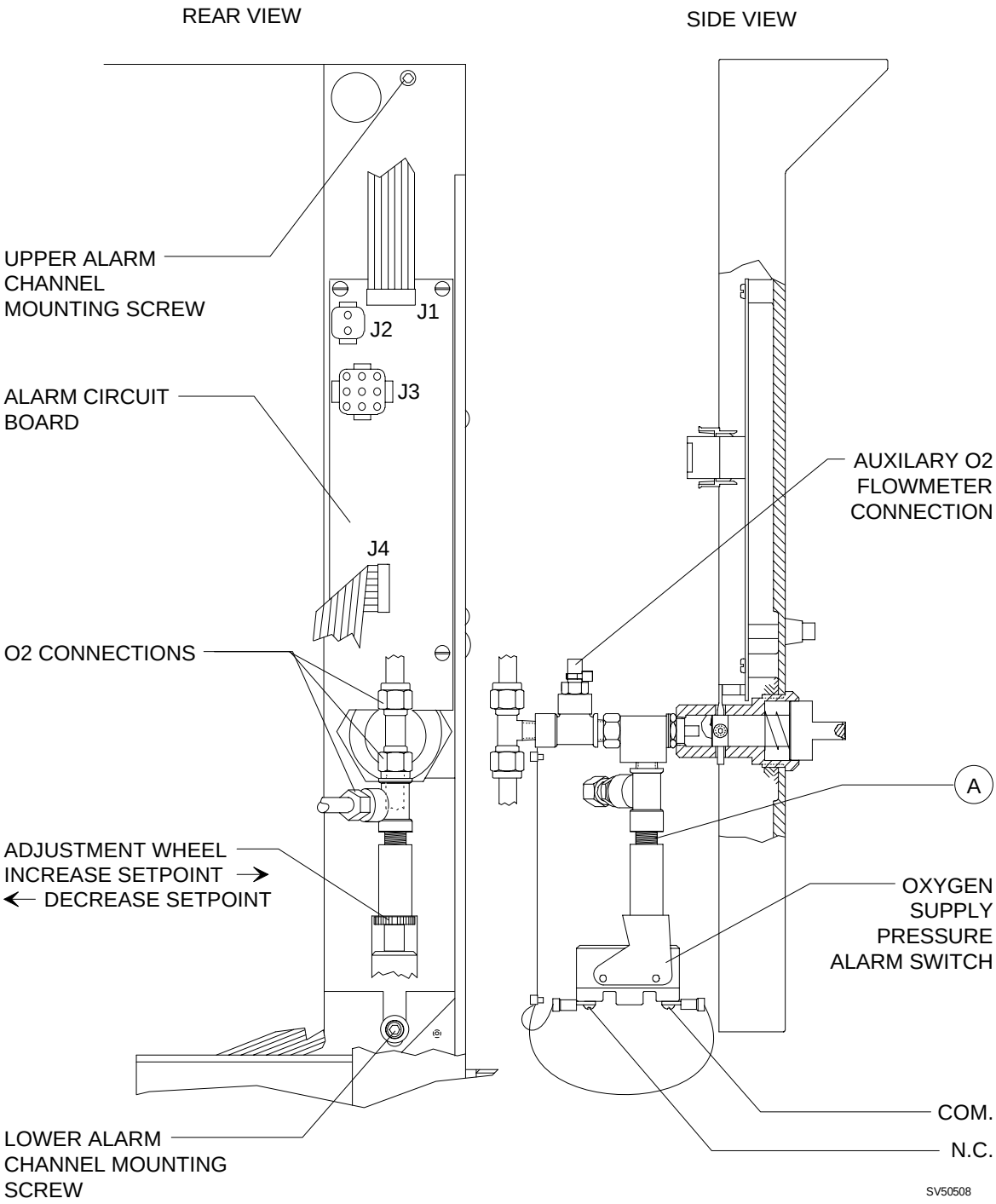

Figure 4-8: ALARM CHANNEL AND OXYGEN SUPPLY PRESSURE ALARM SWITCH

4.8.15 From the back of the flowmeter housing, remove the upper and lower alarm channel mounting screws.

4.8.16 At the front of the machine, pull the alarm channel assembly forward, and feed the flowmeter lights wire harness through the hole at the top of the alarm channel.

4.8.17 Disconnect the orange and orange/white wires from the oxygen supply pressure alarm switch.

4.8.18 The following steps apply to replacement of the oxygen supply pressure alarm switch. If the entire alarm channel assembly is being replaced, skip the next two steps.

4.8.19 Remove the alarm switch from the assembly at point Ⓐ as shown in the illustration.

4.8.20 Install the replacement alarm switch with sealing tape on the threads, and ensure that the switch is oriented on the assembly as shown in the illustration.

4.8.21 Connect the orange and orange/white wires to the replacement switch in the same manner as the original.

4.8.22 Feed the flowmeter lights wire harness through the hole at the top of the alarm channel, and set the alarm channel assembly into place.

4.8.23 Install the upper and lower alarm channel mounting screws.

4.8.24 If applicable, reconnect the flex line from the auxiliary O_2 flowmeter and install a new tie strap at the hose barb.

4.8.25 Reconnect the the O_2 lines, and tighten the three compression fittings.

4.8.26 Reconnect the cables to J1, J2, J3 and J4 on the alarm circuit board.

4.8.27 Reinstall the front flowmeter and vapor box cover with the six screws that were previously removed.

4.8.28 Pull the writing or keyboard tray out to its fully extended position.

4.8.29 Locate the tee fitting in the ¼ in. diameter output line of the O_2 regulator and remove the plug from the tee fitting.

4.8.30 Connect a dedicated O_2 test gauge to the tee fitting.

4.8.31 Connect AC power to the machine and enable the circuit breakers by pressing their buttons in.

4.8.32 Open an oxygen cylinder valve and turn the System Power switch to ON.

4.8.33 Set the oxygen flow to five liters per minute.

4.8.34 Close the oxygen cylinder valve.

4.8.35 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

4.8.36 If the alarm activates when the pressure is below 34 psi or above above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

4.8.37 Turn the System Power switch to STANDBY.

4.8.38 Disconnect the test gauge and replace the plug in the regulator line tee fitting.

4.8.39 Replace the table top and its retaining screws.

4.8.40 Replace the flowmeter housing rear cover and its retaining screws.

4.8.41 Connect the pipeline hoses.

4.8.42 Perform the PMS Procedure given in Section 6.

4.9 Oxygen Ratio Controller

The Oxygen Ratio Controller (ORC) is part of the N_2O flowmeter sub-assembly and is located within the flowmeter housing. The ORC is accessible by removing the rear flowmeter housing cover. Figure 4-9 shows a typical ORC location and mounting arrangement, with a detail of the O-rings and filter.

The following procedure applies to both ORC designs: P/N 4111800, and Low Flow design P/N 4113229.

4.9.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.9.2 Close all cylinder valves except the O_2 valve.

4.9.3 Set the oxygen flow to 5 liters per min.

4.9.4 Open the other gas flow control valves to drain pressure from the system.

4.9.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.9.6 Set the System, Power switch to STANDBY.

4.9.7 Remove the press-on clamp securing the flexible O_2 line to the ORC, and carefully disconnect the tubing from the hose barb.

4.9.8 Remove the three screws holding the ORC to the flowmeter sub-assembly, and carefully remove the ORC from the flowmeter housing.

4.9.9 For low flow ORC (P/N 4113229) replacement, install the 6 in. length of flexible tubing with a blue N_2O label on the replacement ORC (see detail view in illustration) Secure each connection with a press-on hose clamp.

Position the replacement ORC at the back of the N_2O flowmeter sub-assembly; be sure that its O-rings and filter are in place, and install its three mounting screws.

4.9.10 Connect the flexible O_2 line to the ORC and secure it with the press-on hose clamp.

4.9.11 Open the O_2 and N_2O cylinder valves.

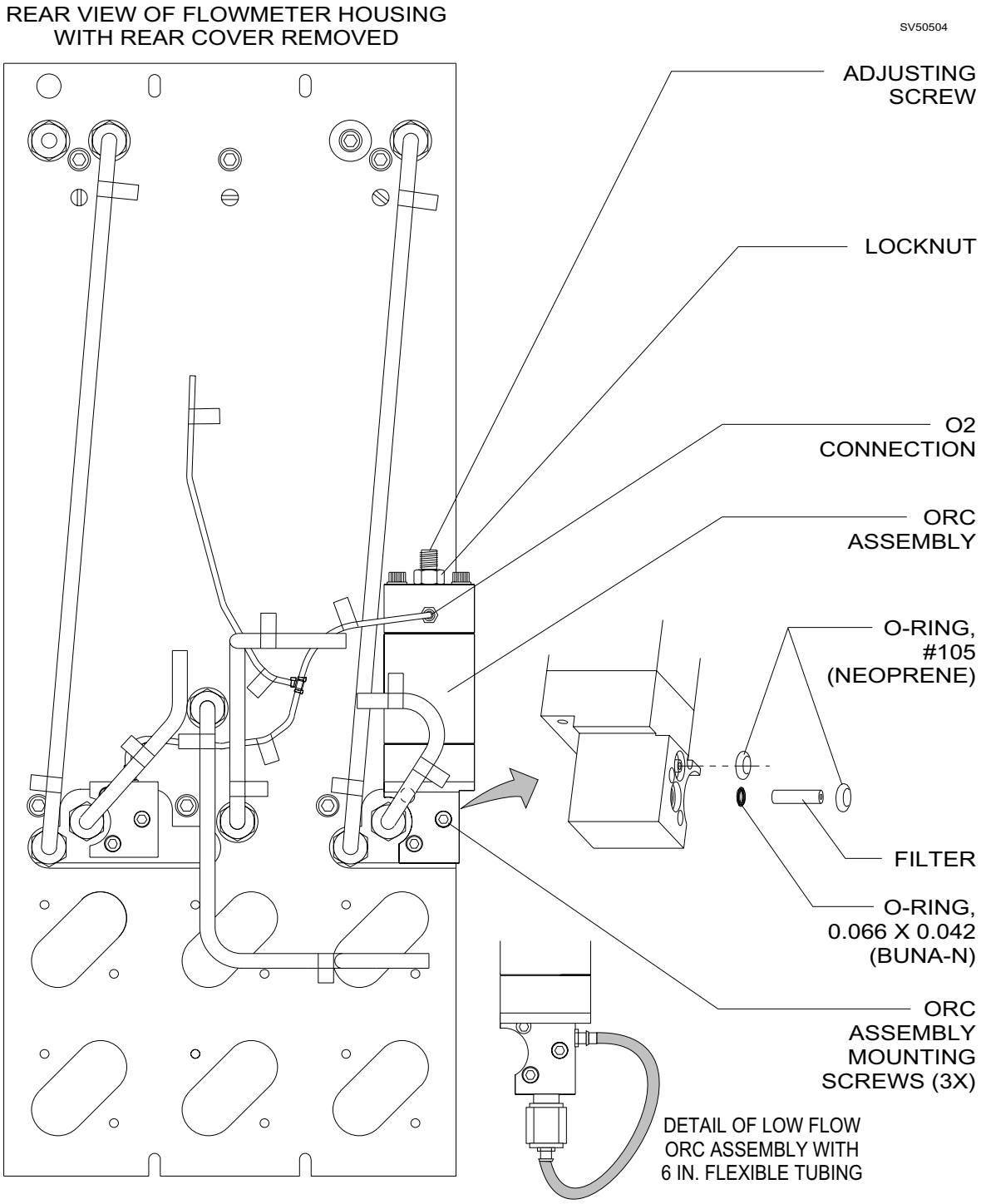

Figure 4-9: OXYGEN RATIO CONTROLLER

4.9.12 Perform the ORC adjustment procedure given in Section 5 of this manual.

NOTE: There are two adjustment procedures - one for ORC P/N 411800, and one for low flow ORC P/N 4113229. Be sure to follow the correct procedure.

4.9.13 Reinstall the flowmeter housing rear cover.

4.9.14 Perform the PMS Procedure given in Section 6.

4.10 Vaporizers

Each vaporizer is held to the machine by two metric sized hex screws. These screws are accessible at the back of the vaporizer mount, below the interlock mechanism as shown in Figure 4-10. Before removing a vaporizer from the machine, it must be completely drained and dried in accordance with the procedure given below. Be sure to have a suitable packing or storage container available in which to place the vaporizer.

CAUTION: The following steps must be performed in the sequence given.

4.10.1 Set the System Power switch to ON.

4.10.2 Set all vaporizer handwheels to their Zero or OFF position.

WARNING: Do not inhale anesthetic vapors as this could result in personal injury.

4.10.3 Remove the filler and drain plugs, and drain the vaporizer into a suitable container. Dispose of the residual agent in an approved manner.

4.10.4 Turn the vaporizer handwheel to the maximum concentration setting.

4.10.5 Set the oxygen flow to 10 l/min. for at least 20 minutes.

WARNING: This procedure must be performed in a well ventilated area and without personnel present.

4.10.6 Turn the vaporizer handwheel to 0 (zero), and replace the filler and drain plugs.

4.10.7 Turn the oxygen flow off, and set the System Power switch to STANDBY.

4.10.8 While holding the vaporizer, remove the mounting screws and carefully separate the vaporizer from the machine. Note the arrangement of gaskets so that the replacement vaporizer can be installed in the same manner.

4.10.9 Place the vaporizer in a suitable container for transport or storage.

WARNING: Do not tilt a vaporizer that contains anesthetic agent more than 45 degrees. Failure to observe this precaution will render the handwheel calibration invalid.

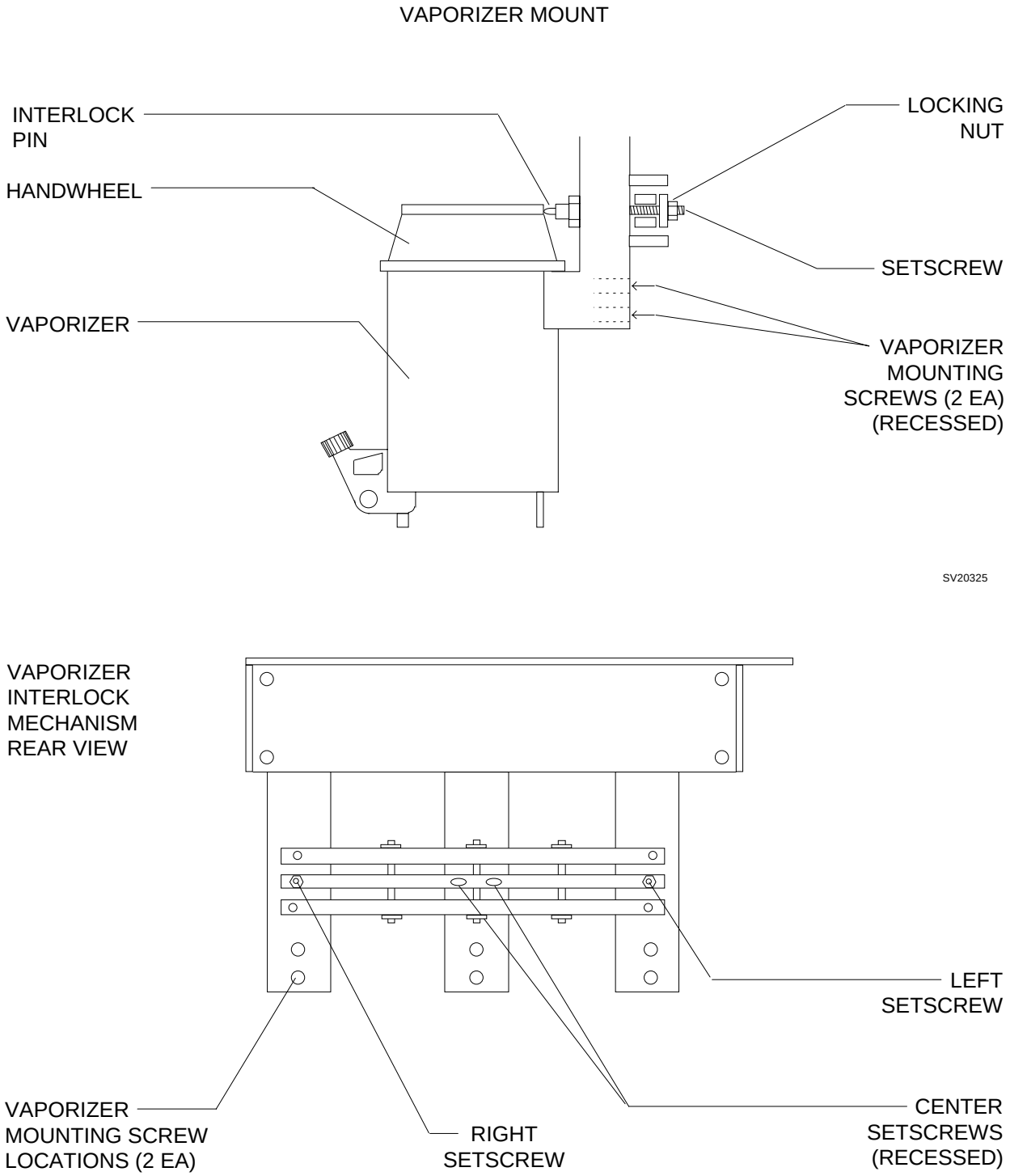

Figure 4-10: VAPORIZER INSTALLATION AND INTERLOCK ADJUSTMENT

NOTE: Should a vaporizer containing anesthetic agent be accidentally tilted more than 45 degrees, it must be drained and flushed in accordance with instructions given in the manual supplied with the vaporizer.

4.10.10 Set the handwheel on the replacement vaporizer to its Zero position.

4.10.11 Install the replacement vaporizer on the machine (be sure the O-rings are in place) and tighten the mounting screws to a torque of 24 to 26.5 inch pounds.

4.10.12 Perform the following test on the interlock mechanism and make any necessary adjustments:

4.10.12.1 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

4.10.12.2 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

4.10.12.3 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

4.10.13 Perform the PMS Procedure given in Section 6.

4.11 O2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the fresh gas outlet. Access to the flush valve requires removal of the table top. Figure 4-11 shows the mounting and assembly details of the flush valve.

4.11.1 Set the System Power switch to STANDBY.

4.11.2 Disconnect all pipeline hoses.

4.11.3 Close the O_2 cylinder valve.

4.11.4 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.11.5 Remove the screws holding the table top to the machine and lift out the table top.

4.11.6 Hold the O_2 Flush button in and rotate it until one of its set screws are visible through an access hole in the guard ring, and loosen the set screw.

4.11.7 Turn the O_2 Flush button 180 degrees, hold it in and loosen the other set screw.

4.11.8 Remove the O_2 Flush button and washer from the valve shaft.

4.11.9 Disconnect the two compression fittings at the valve.

NOTE: Do not lose the flow restrictor located at the right-angle fitting. This restrictor will be transferred to the replacement valve assembly.

4.11.10 The O_2 Flush valve is retained by the guard ring on the front of the machine frame. Hold the body of the Clippard valve with an open end wrench; insert a rod or hex wrench through the holes in the guard ring (or use a spanner wrench), and un-screw the guard ring from the front of the frame rail.

4.11.11 Assemble the replacement O_2 Flush valve, spacer, internal tooth lock washer and guard ring through the frame and tighten the assembly, making sure that the valve is mounted straight.

4.11.12 Connect the compression fittings to the valve. Be sure the flow restrictor is in place at the right-angle fitting.

4.11.13 Place the washer and the O_2 Flush button on the valve shaft.

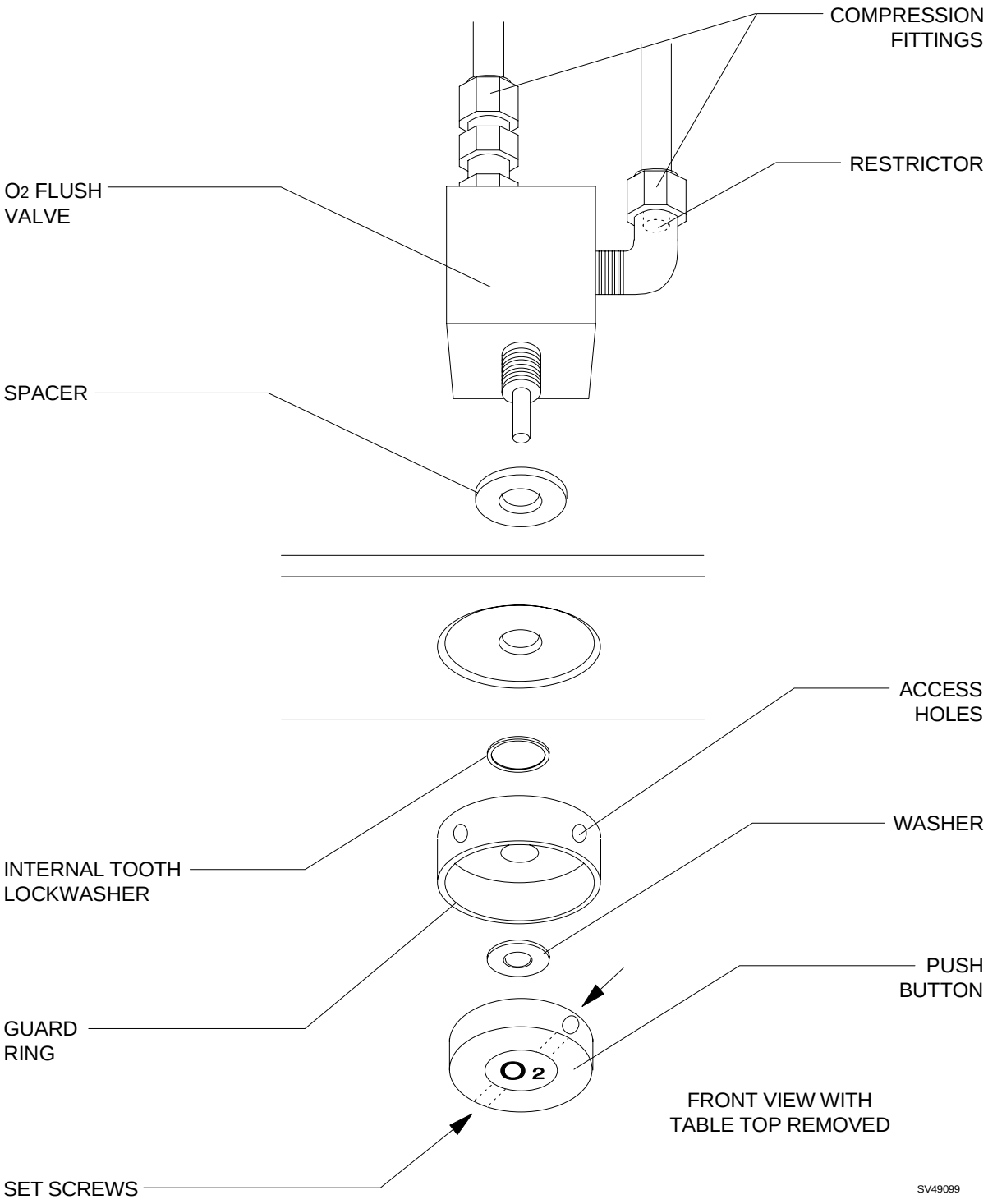

Figure 4-11: O_2 FLUSH VALVE

4.11.14 Hold the O_2 Flush button in and turn it until a set screw is visible through an access hole in the guard ring. Tighten the set screw. Rotate the button 180 degrees until the other set screw is visible, and tighten the set screw.

4.11.15 Disconnect the absorber fresh gas hose from the fresh gas outlet. Connect a test gauge and B.P. bulb to the fresh gas outlet, and perform the following test:

4.11.15.1 Open the oxygen cylinder valve.

4.11.15.2 Release any pressure that is indicated on the test gauge.

4.11.15.3 Over the next 60 seconds, the test gauge should not show a pressure increase greater than 2 cm H_2O.

4.11.15.4 Increase the pressure to 50 cm H_2O.

4.11.15.5 The pressure should not drop more than 10 cm H_2O in the next 30 seconds.

4.11.15.6 Disconnect the test gauge from the fresh gas outlet.

4.11.15.7 Open the oxygen cylinder valve and allow the pressure to stabilize. (The cylinder pressure must be at least 1000 psi for this test.)

4.11.15.8 Close the oxygen cylinder valve.

4.11.15.9 The pressure should not drop more than 50 psi in two minutes.

4.11.15.10 Connect a volumeter to the fresh gas outlet, and reset the volumeter to zero.

4.11.15.11 Press the O_2 Flush button and observe the flow rate. It should be between 45 and 65 liters per minute.

4.11.15.12 Disconnect the volumeter from the fresh gas outlet.

4.11.16 Connect the absorber fresh gas hose to the fresh gas outlet.

4.11.17 Replace the table top and secure it with the mounting screws.

4.11.18 Connect the pipeline hoses.

4.11.19 Perform the PMS Procedure given in Section 6.

4.12 AV-2 and AV-2+ Ventilator Controller Assembly

The Ventilator Controller assembly is attached to the left front panel of the ventilator box and includes electrical and pneumatic components. Figures 4-12 and 4-12A show the mounting screw locations and connections to the ventilator controller.

4.12.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.12.2 Disconnect all pipeline hoses and close all cylinder valves.

CAUTION: The controller circuit board contains static sensitive devices. Use ESD protection when handling the controller assembly.

4.12.3 Remove the two screws securing the left end of the ventilator controller panel.

4.12.4 Pull the left side of the panel outward, slide it to the left until the locking tab on the right side of the panel is clear of its receptacle, then pull the assembly out far enough to gain access to its connections.

4.12.5 Disconnect the alarm channel wiring harness from J2 on the controller circuit board. On AV2+ controllers, also disconnect the Man/Auto selector interface cable from J7 on the circuit board.

4.12.6 Disconnect the following large and small diameter pneumatic tubing (the letters are keyed to the illustration):

A: Small dia. tube from solenoid to rear vent fitting on bellows box
B: Large dia. tube from supply valve to venturi
C: Small dia. tube to auto-ranging valve
D: Large dia. tube from main switch (O_2 supply)

4.12.7 Remove the controller assembly from the machine.

4.12.8 Position the replacement controller assembly in the ventilator box and reconnect the four pneumatic lines.

4.12.9 Reconnect the alarm channel wire harness to J2 on the controller circuit board. On AV2+ controllers, also reconnect the Man/Auto selector interface cable to J7 on the circuit board.

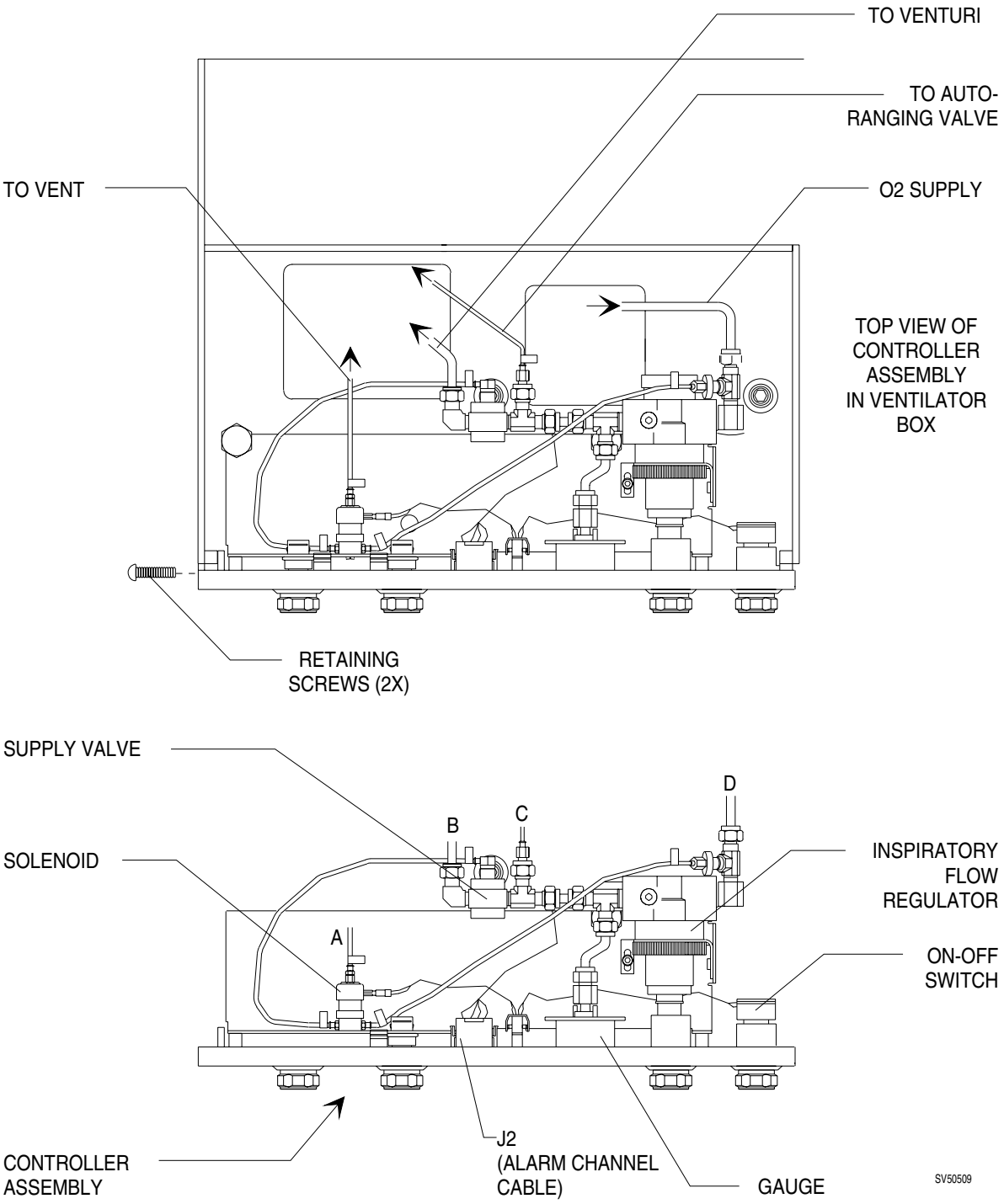

Figure 4-12: AV2 VENTILATOR CONTROLLER ASSEMBLY

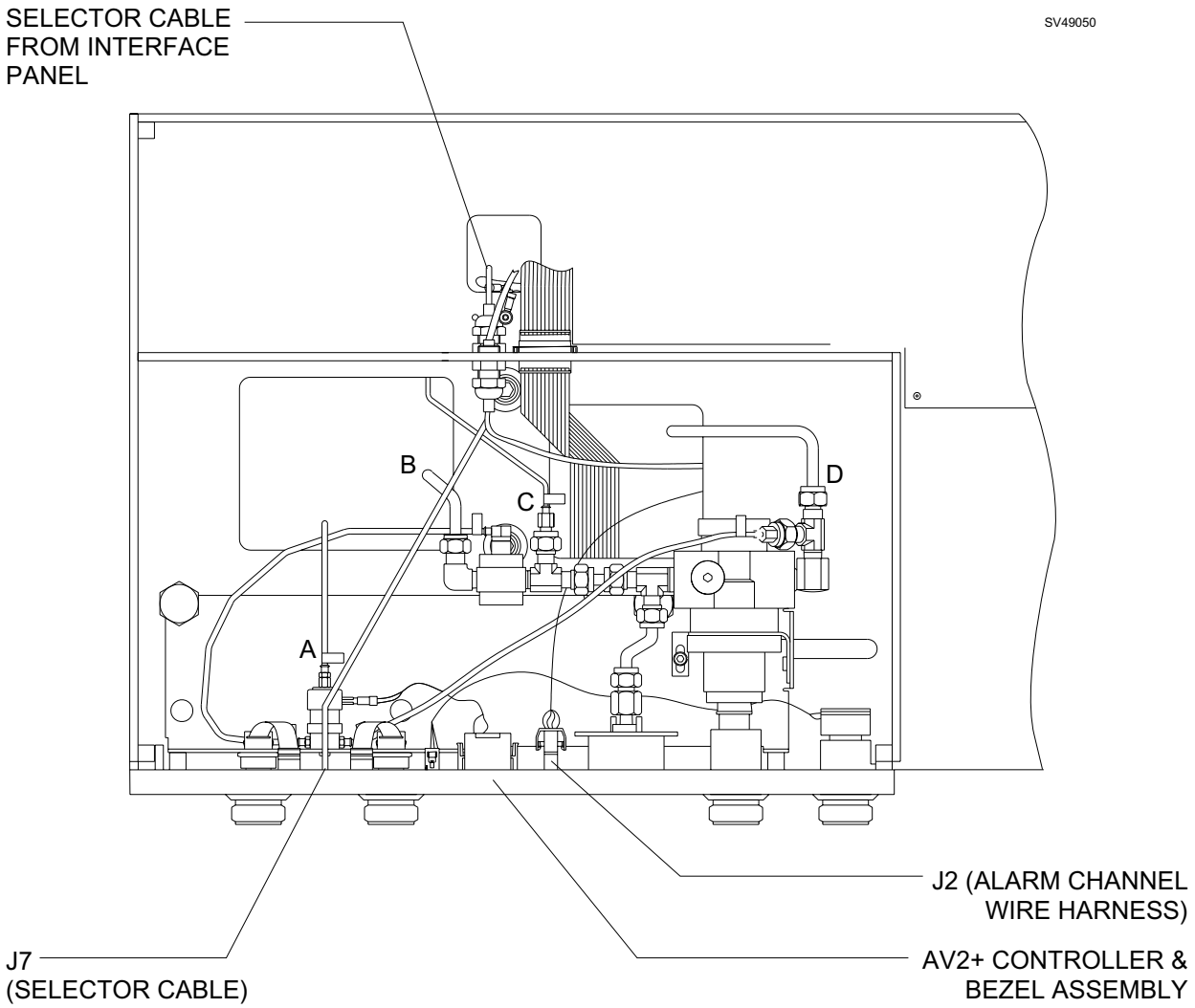

Figure 4-12A: AV2+ VENTILATOR CONTROLLER ASSEMBLY

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4.12.10 Slide the controller into the ventilator box, carefully fit the locking tab into its receptacle at the right side of the panel, and slide the assembly to the right until it is properly seated.

4.12.11 Reinstall the two retaining screws at the left side of the panel.

4.12.12 Perform the PMS Procedure given in Section 6.

4.13 Convenience Outlet AC Power Filter

The convenience outlet AC power filter is located at the back of the ventilator box near the AC convenience outlets. Access to the power filter requires removal of the ventilator box top panel. Figure 4-13 shows the location of the filter, its connections and its mounting arrangement.

4.13.1 Set the System Power switch to STANDBY and remove AC power from the machine.

4.13.2 Disable all circuit breakers by pulling each button out with a knife or sharp object.

4.13.3 If the machine is equipped with a second shelf, remove any items from the shelf and remove the shelf from the machine.

4.13.4 Remove the four screws securing the ventilator box top panel. Disconnect the ground wire and remove the panel.

4.13.5 Remove the two screws holding the safety cover over the AC power filter, and remove the cover.

4.13.6 Disconnect the AC wiring from each side of the filter. Note the position of the wires so they can be attached to the replacement filter in the same manner.

4.13.7 Unscrew the two hex post nuts holding the filter to the ventilator box, and remove the filter.

4.13.8 Install the replacement filter and secure it with the two hex post nuts.

4.13.9 Connect the AC wiring to the replacement filter. Be sure to observe the wire color code as illustrated.

4.13.10 Place the safety cover over the filter and secure it with the two screws that were previously removed.

4.13.11 Reconnect the ventilator box top panel ground wire, and reinstall the panel with the four screws that were previously removed.

4.13.12 If applicable, reinstall the top shelf on the machine.

4.13.13 Enable all circuit breakers by pressing their buttons in.

4.13.14 Restore power to the machine and perform the PMS Procedure given in Section 6.

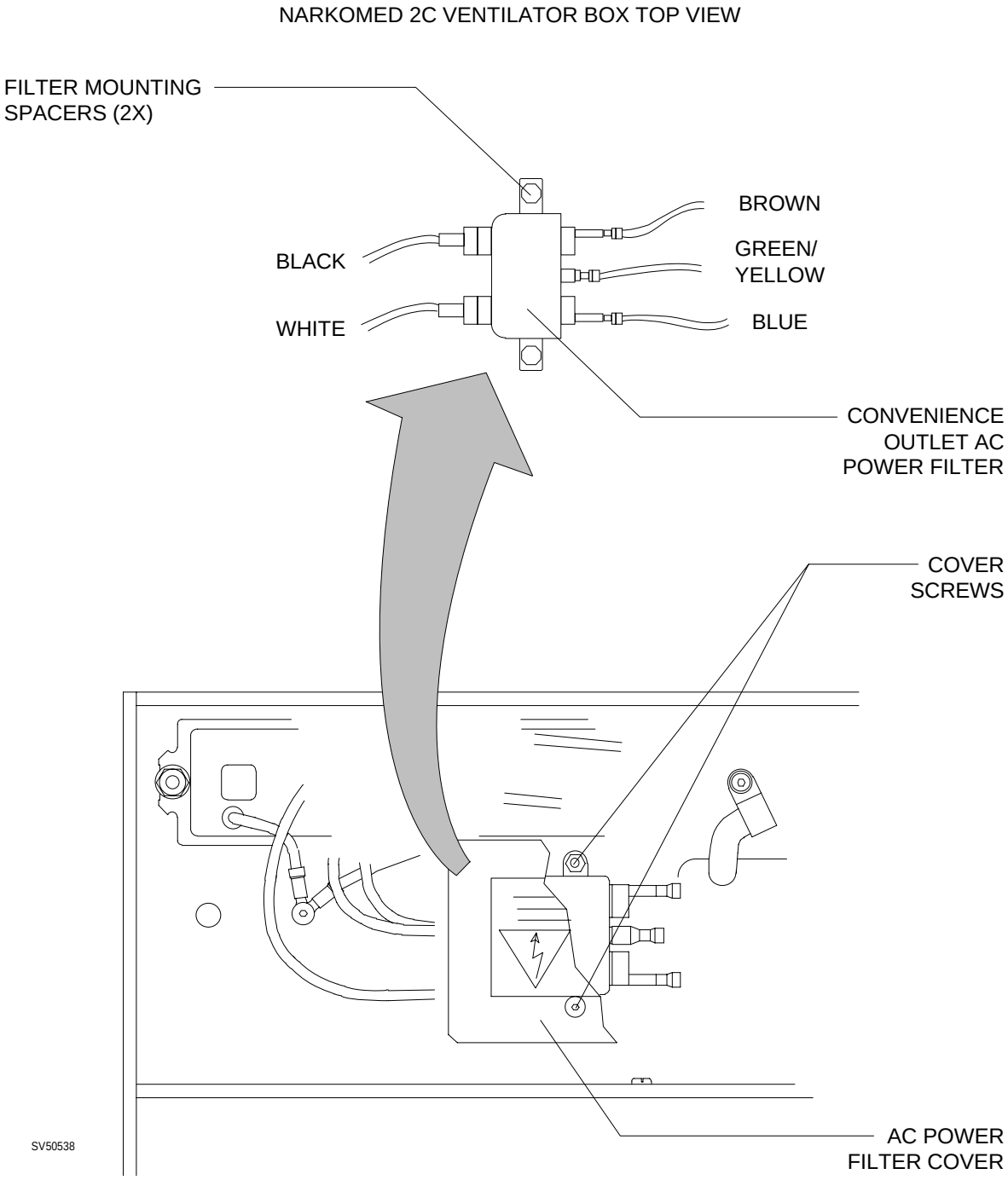

Figure 4-13: CONVENIENCE OUTLET POWER FILTER

4.14 Ventilator Bellows Valve and Guide Assembly with Pressure Limit Control

The Ventilator Bellows Valve and Guide Assembly, and the Pressure Limit Control are located in the bellows box on the left side of the machine. Access to the components requires removal of the bellows box front panel, and removal of the upper bellows support plate from the bellows box. Figure 4-14 shows the pneumatic connections and the mounting arrangement of the components.

4.14.1 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.14.2 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.14.3 Press the O_2 Flush button to relieve pressure from the system.

4.14.4 Adjust the TIDAL VOLUME control to raise the volume indicator to its maximum setting.

4.14.5 Disconnect the breathing hose and the scavenger hose from the bellows assembly. Loosen the wing nuts and remove the bellows assembly.

4.14.6 Remove the canister from the bellows box by pulling it downward.

4.14.7 Unscrew the bellows guide from the adjustment rod.

4.14.8 Loosen the set screws on the tidal volume indicator (note the position of the indicator on the adjustment rod so that it can be reassembled in the same position) and remove the indicator.

4.14.9 Remove the screws holding the bellows box front panel and knob assemblies, and remove the panel.

4.14.10 Loosen the rear support plate screw, and remove the two front support plate screws.

4.14.11 Pull the support plate forward, then lower it to a point where the tubing connections are accessible.

4.14.12 Disconnect the large diameter tubing from the venturi, and the small diameter tubing from the auto-ranging valve.

4.14.13 Carefully remove the assembly from the machine. Mounting screws for the adjustable pressure limit control and the valve case assembly are shown in the illustration.

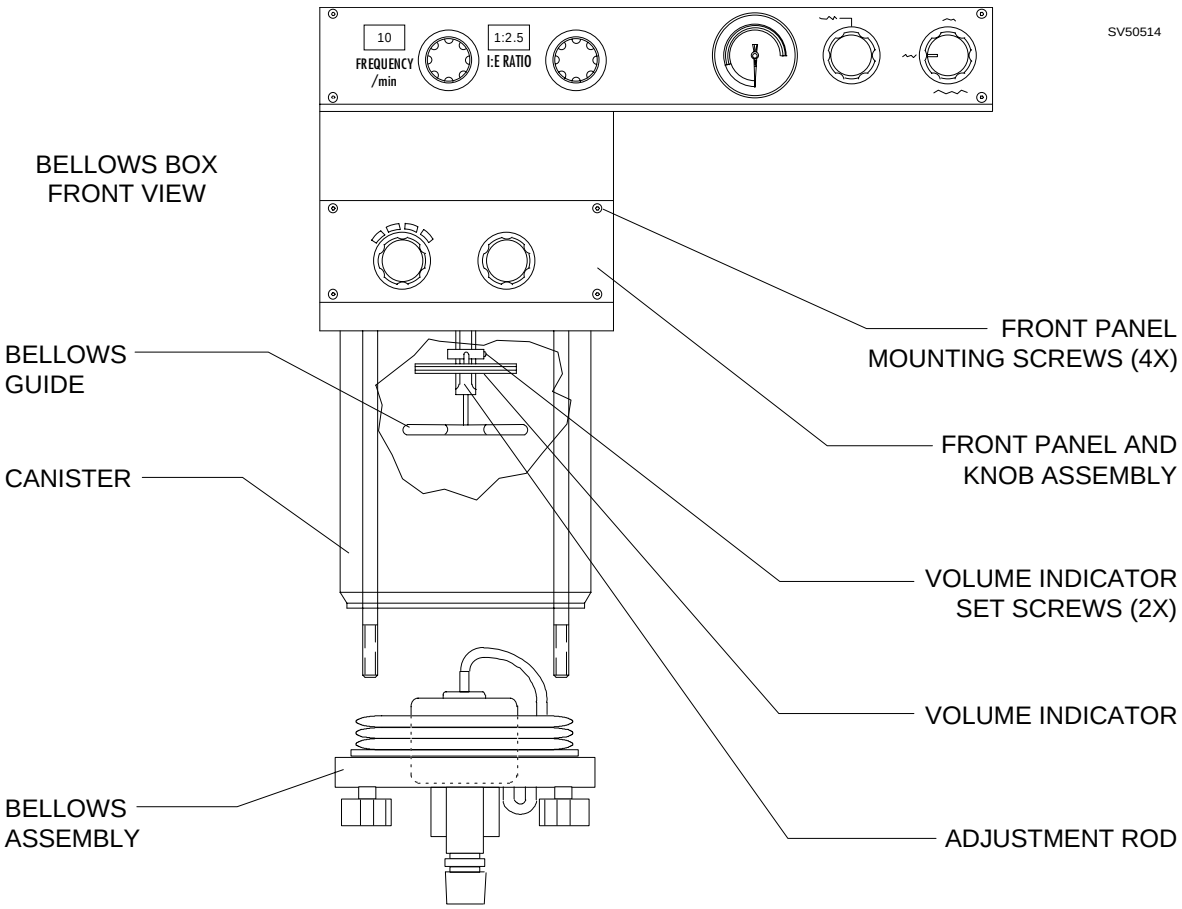

Figure 4-14: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY

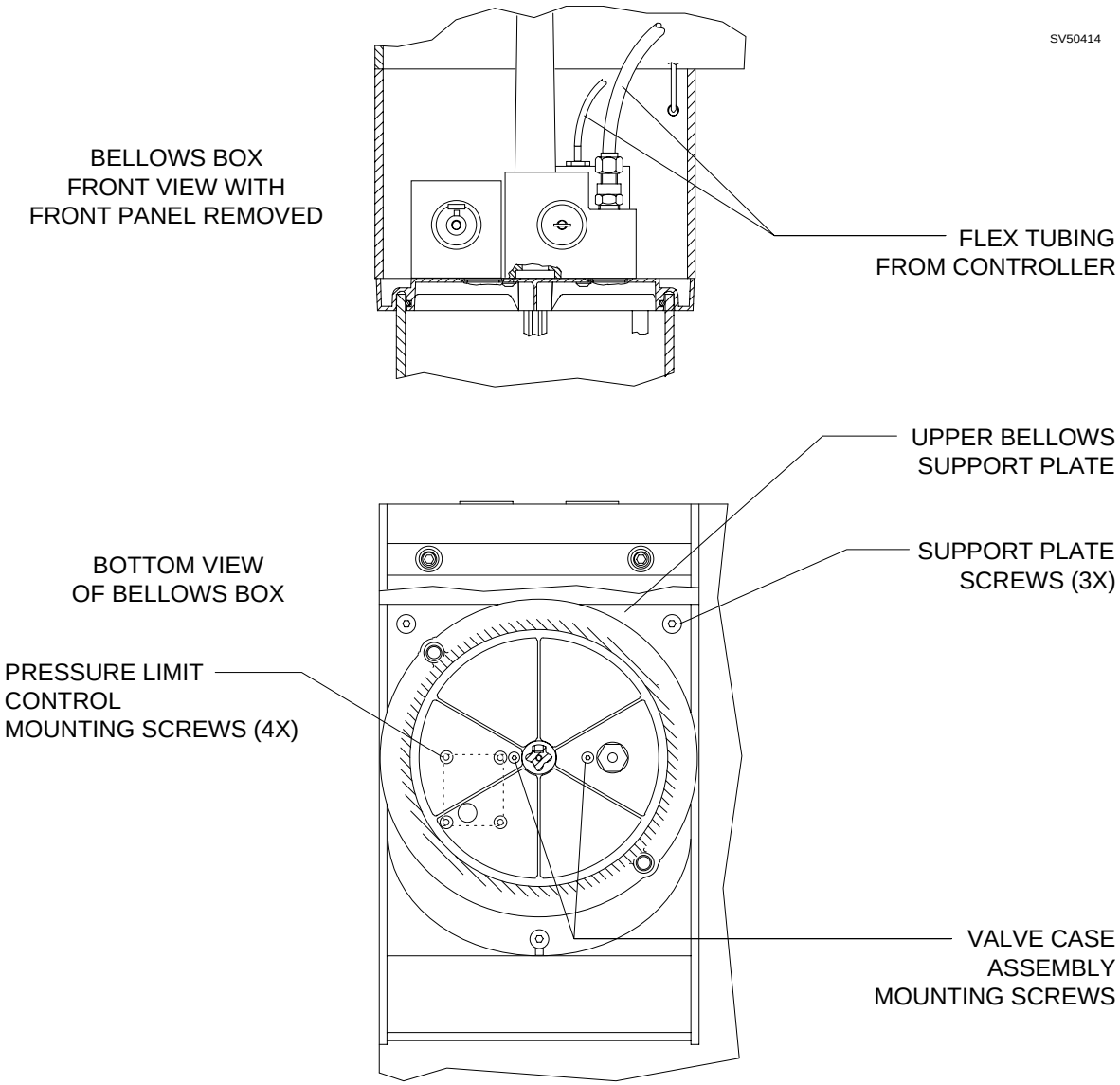

Figure 4-14: TIDAL VOLUME ADJ. & VALVE CASE ASSEMBLY (continued)

NOTE: If components are removed from the support plate, be sure that any spacers and O-rings are correctly positioned during reinstallation.

4.14.14 Following component replacement, position the support plate in the bellows box and reconnect the large and small diameter tubing that was previously removed.

4.14.15 Slide the support plate up and to the rear until it is seated properly in the bellows box.

4.14.16 Reinstall the two front support plate screws, and tighten the rear support plate screw.

4.14.17 Install the volume indicator on the bellows adjustment rod in the same position as before disassembly, and tighten its two setscrews.

4.14.18 Install the bellows guide by screwing its stem into the bellows adjustment rod.

4.14.19 Place the bellows box front panel into position, ensure that the slots in the knob assemblies are correctly aligned with their drive pins on the bellows adjustment and pressure limit control shafts, and reinstall the screws holding the front panel to the machine.

4.14.20 Replace the bellows canister; ensure that its markings are facing forward.

4.14.21 Replace the bellows assembly and tighten the wing nuts holding it in place.

4.14.22 Reconnect any hoses that were previously removed from the bellows assembly.

4.14.23 Reconnect the pipeline hoses and AC power cord.

4.14.24 Perform the PMS Procedure given in Section 6.

4.15 Caster

Each caster is retained by a set screw in the side of the lower frame rail as shown in Figure 4-15. Caster replacement requires that the machine be tilted to provide enough clearance for the caster stem to be withdrawn from the bottom of the frame rail.

WARNING: Do not tilt the machine more than 10 degrees or raise the casters more than 3½ inches from the floor. Failure to observe this precaution may result in a tip-over, causing personal injury. Vaporizers containing anesthetic agent may also be damaged.

4.15.1 Obtain a brace capable of supporting one side of the machine with its casters two to three inches from the floor.

4.15.2 Remove all unsecured equipment and accessories from the machine.

4.15.3 Lock the front casters.

4.15.4 Using at least two people, tilt the machine until the casters on one side are raised two to three inches from the floor, and position the support brace under the frame rail between the front and back casters.

4.15.5 Remove the plastic cap in the side of the frame rail to provide access to the caster stem set screw.

4.15.6 Loosen the set screw and remove the caster.

4.15.7 Insert the replacement caster into the frame and hold it in its seated position.

4.15.8 Tighten the caster stem set screw and replace the plastic cap in the frame rail.

4.15.9 Using at least two people, tilt the machine, remove the support brace and carefully lower the machine to the floor.

4.15.10 Check for proper operation of the caster and ensure that the front casters lock properly.

4.15.11 Perform the PMS Procedure given in Section 6, including a vaporizer calibration verification.

4.15.12 Replace any unsecured equipment and accessories that were previously removed.

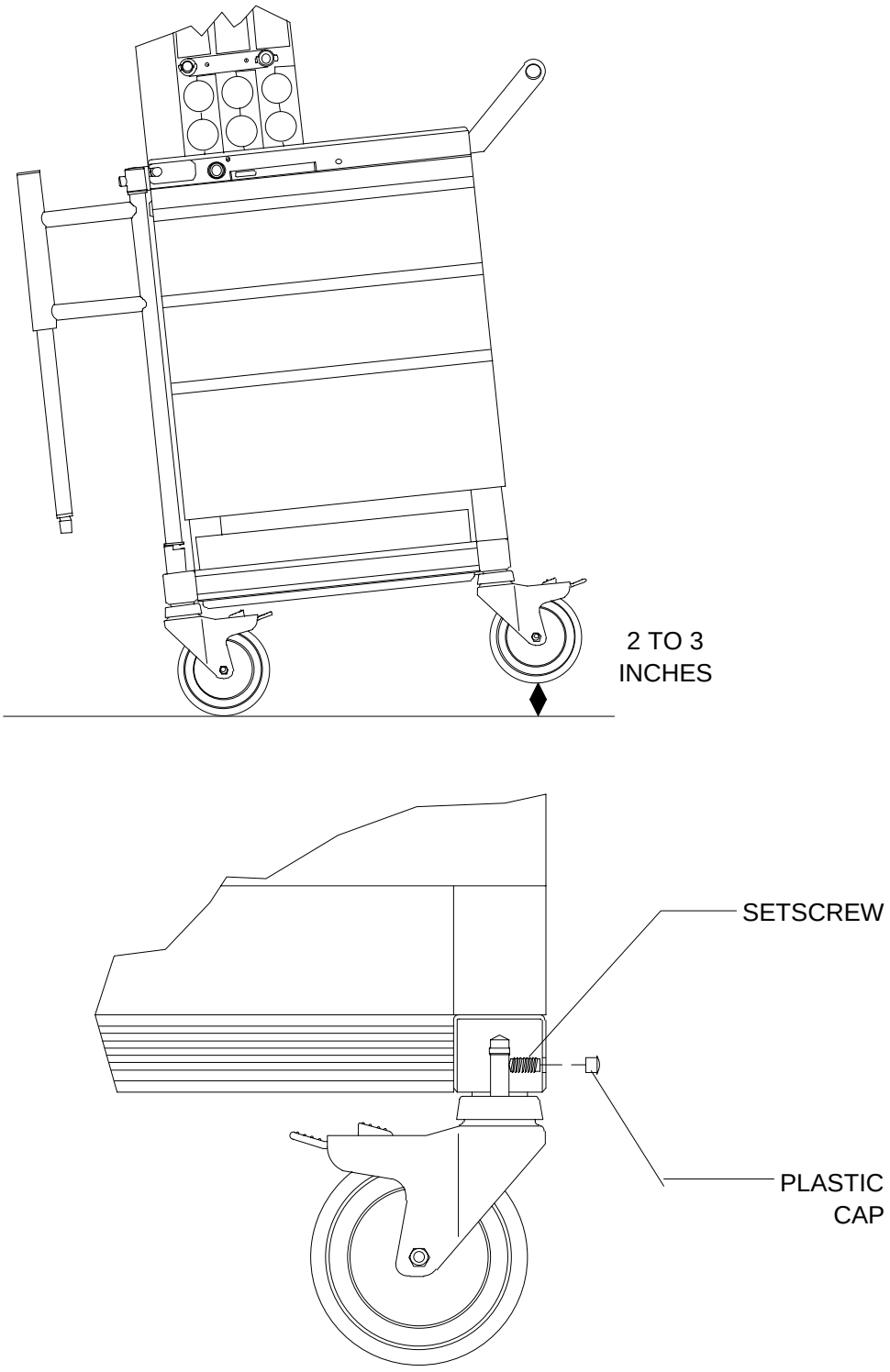

Figure 4-15: CASTER REPLACEMENT

4.16 Battery

The backup battery is located in the power supply compartment below the cabinet drawers. Access to the power supply requires removal of the lower drawers and removal of the power supply compartment cover. Figure 4-16 shows the power supply connection and mounting arrangement.

4.16.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.16.2 Disable the circuit breakers on the side of the power supply compartment by pulling out each button with a knife or sharp object.

4.16.3 Remove the bottom and center drawers from the cabinet by pulling each one out to its fully extended position, pressing in the locking tabs and lifting it from the tracks.

WARNING: Ensure that AC power is removed from the machine before opening the power supply compartment cover. Failure to observe this precaution may cause injury by electric shock.

4.16.4 Remove the four screws holding the power supply compartment cover, and remove the cover.

4.16.5 Remove the screw holding the battery retainer bar, and remove the retainer bar.

4.16.6 Disconnect the battery wire harness from TB1, terminals 1 & 2 on the power supply chassis, and from the center circuit breaker (CB2). Note the wire color and position of the wires so that the harness can be reinstalled in the same manner.

4.16.7 Lift the battery from the compartment.

4.16.8 Transfer the wire harness to the replacement battery. Ensure that the battery is connected in the same polarity as the original battery. Place the battery in the protective bag in the same manner as the original.

4.16.9 Place the replacement battery in the compartment, with the terminals oriented as shown in the illustration.

4.16.10 Reinstall the battery retainer bar by placing its tab through the slot in the compartment, and replacing the retainer screw at the other end of the bar.

4.16.11 Connect the wiring harness to circuit breaker CB2, and to TB1, terminals 1 & 2 on the power supply chassis. Connect the yellow wire to Terminal 1 and the black wire to Terminal 2 as shown in the illustration.

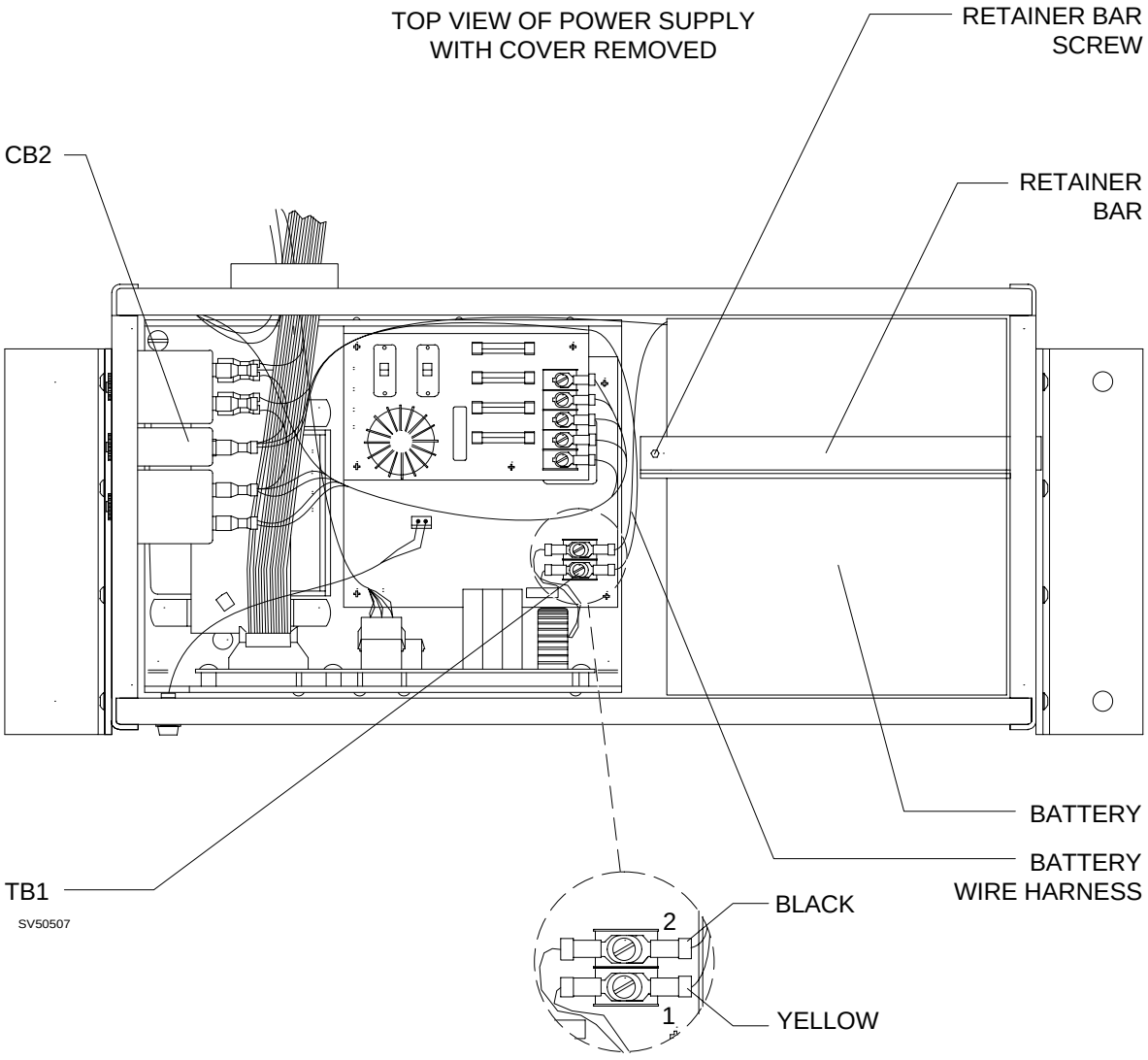

Figure 4-16: BATTERY REPLACEMENT

4.16.12 Reinstall the power supply compartment cover with the four screws that were previously removed.

4.16.13 Reinstall the bottom and center cabinet drawers. Ensure that the locking tabs are correctly in place.

4.16.14 Enable the circuit breakers and restore power to the machine.

4.16.15 Perform the PMS Procedure given in Section 6.

4.17 Power Supply

The primary power supply is located in the power supply and battery compartment below the cabinet drawers. Access to the power supply requires removal of the lower drawers and removal of the power supply compartment cover. Figure 4-17 shows the power supply connection and mounting arrangement.

4.17.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.17.2 Disable the circuit breakers on the side of the power supply compartment by pulling out each button with a knife or sharp object.

4.17.3 Remove the bottom and center drawers from the cabinet by pulling each one out to its fully extended position, pressing in the locking tabs and lifting it from the tracks.

WARNING: Ensure that AC power is removed from the machine before opening the power supply compartment cover. Failure to observe this precaution may cause injury by electric shock.

4.17.4 Remove the four screws holding the power supply compartment cover, and remove the cover.

4.17.5 Place a support under the power supply compartment and remove the screws holding the compartment to the frame rails. Lower the front of the compartment to gain access to the inside.

4.17.6 Disconnect the following items from the bottom board on the power supply:

J2: Lamp Connector (bottom board)
TB1: Battery Wire Harness (two wires)
TB2: Circuit Breaker Wire Harness (five wires)

Note the wire color and position of the wires so that the replacement power supply can be connected in the same manner.

4.17.7 Disconnect the following cables from the side board of the power supply:

J2: Ribbon Cable to Alarm Channel
J3: Wire Harness to Processor

4.17.8 Remove the screw holding the battery retainer bar, and remove the retainer bar.

4.17.9 Remove the screw on the underside of the power supply compartment securing the battery retainer bar post, and remove the post.

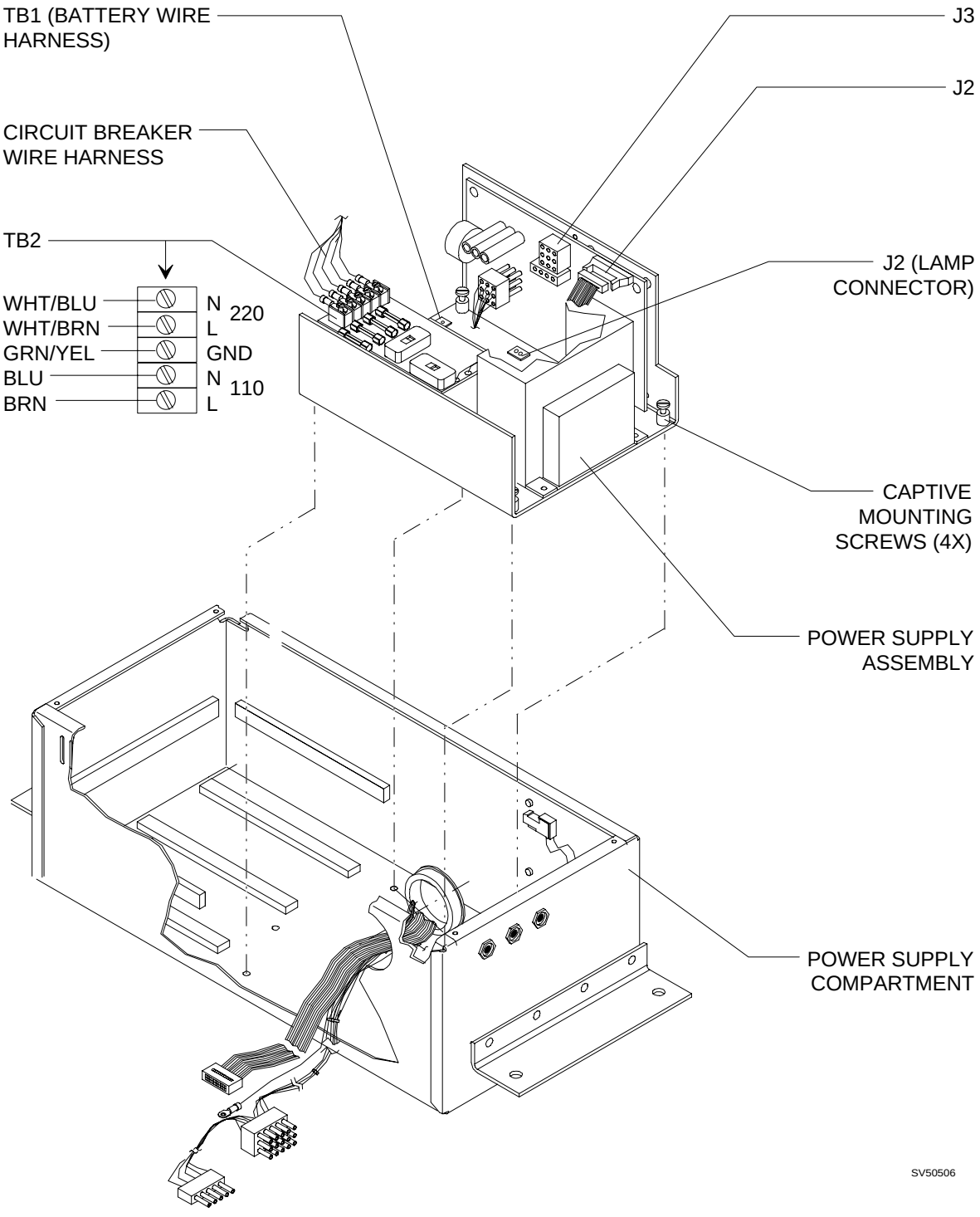

Figure 4-17: POWER SUPPLY

4.17.10 Disconnect the battery wire harness from the center circuit breaker (CB2). Note the wire color and position of the wires so that the harness can be reinstalled in the same manner.

4.17.11 Lift the battery from the compartment.

4.17.12 Loosen the four captive mounting screws on the power supply chassis. Lift the power supply ¾ in. and slide it to the right until the left edge of the supply clears the circuit breaker wires. Lift the power supply from the box.

4.17.13 Position the replacement power supply chassis in the box and tighten the four captive mounting screws.

4.17.14 Place the battery in the compartment.

4.17.15 Reinstall the battery bar post.

4.17.16 Reinstall the battery retainer bar by placing its tab through the slot in the compartment and reinstalling the retainer screw at the other end of the bar.

4.17.17 Connect the battery wire harness to circuit breaker CB2.

4.17.18 Connect the cables that were previously removed from J2 and J3 on the side board of the power supply.

4.17.19 Connect the battery wire harness and the circuit breaker wire harness to their terminal blocks as noted in the following tables:

Battery Wire Harness Connections to TB1:

TERMINAL	WIRE COLOR
1	Yellow
2	Black

Circuit Breaker Wire Harness Connections to TB2:

TERMINAL	WIRE COLOR
N 220V	White/Blue
L 220V	White/Brown
GND	Green/Yellow
N 110V	Blue
L 110V	Brown

4.17.20 Join the lamp connector to J2 on the bottom board of the power supply.

Power Indicator Lamp Wire Connections to J2:

TERMINAL	WIRE COLOR
1	Black
2	Red

4.17.21 Reinstall the power supply compartment to the frame rails with the hardware that was previously removed.

4.17.22 Reinstall the power supply compartment cover with the four screws that were previously removed.

4.17.23 Reinstall the bottom and center cabinet drawers. Ensure that their locking tabs are correctly in place.

4.17.24 Enable the circuit breakers and restore power to the machine.

4.17.25 Perform the PMS Procedure given in Section 6.

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4.18 Processor Assembly

The Processor Assembly is located in the ventilator chassis and is accessible by removing the back panel of the ventilator box. Figure 4-18 shows the electrical and pneumatic connections to the processor assembly, and its mounting arrangement.

4.18.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Do not plug or unplug the remote display with power applied.

4.18.2 Disconnect any serial interface or printer cables from their ports on the underside of the ventilator chassis. Disconnect the Datagrip and remote display cables.

4.18.3 Remove the six screws securing the back panel of the ventilator box, and remove the panel.

CAUTION: The processor board contains static sensitive devices. Use ESD protection when handling this assembly.

4.18.4 Disconnect the O.R. DATA MANAGER ribbon cable from J5 on the processor board.

4.18.5 Remove the two processor assembly mounting screws from the underside of the ventilator chassis.

4.18.6 Slide the processor assembly out of the ventilator chassis and carefully disconnect the following:

J1: O_2 Sensor Cable	J17: Volume Sensor Cable
J2: Speaker Wire Harness	J19: Vapor Box Cable
J15: Pwr Supply Wire Harness	J22: Fan Wire Harness
J16: Ventilator Box Cable	Breathing Pressure Sensor Hose

4.18.7 Inspect the jumper on JP1 on the replacement processor assembly and ensure it is installed on both pins of JP1 before installing the processor assembly.

NOTE: This jumper is not placed on both pins of JP1 in order to prevent backup battery drain while the processor assembly is in stock.

4.18.8 Position the replacement processor assembly part way into the ventilator chassis and connect the breathing pressure hose to the sensor on the processor board. Carefully connect all of the cables that were previously removed.

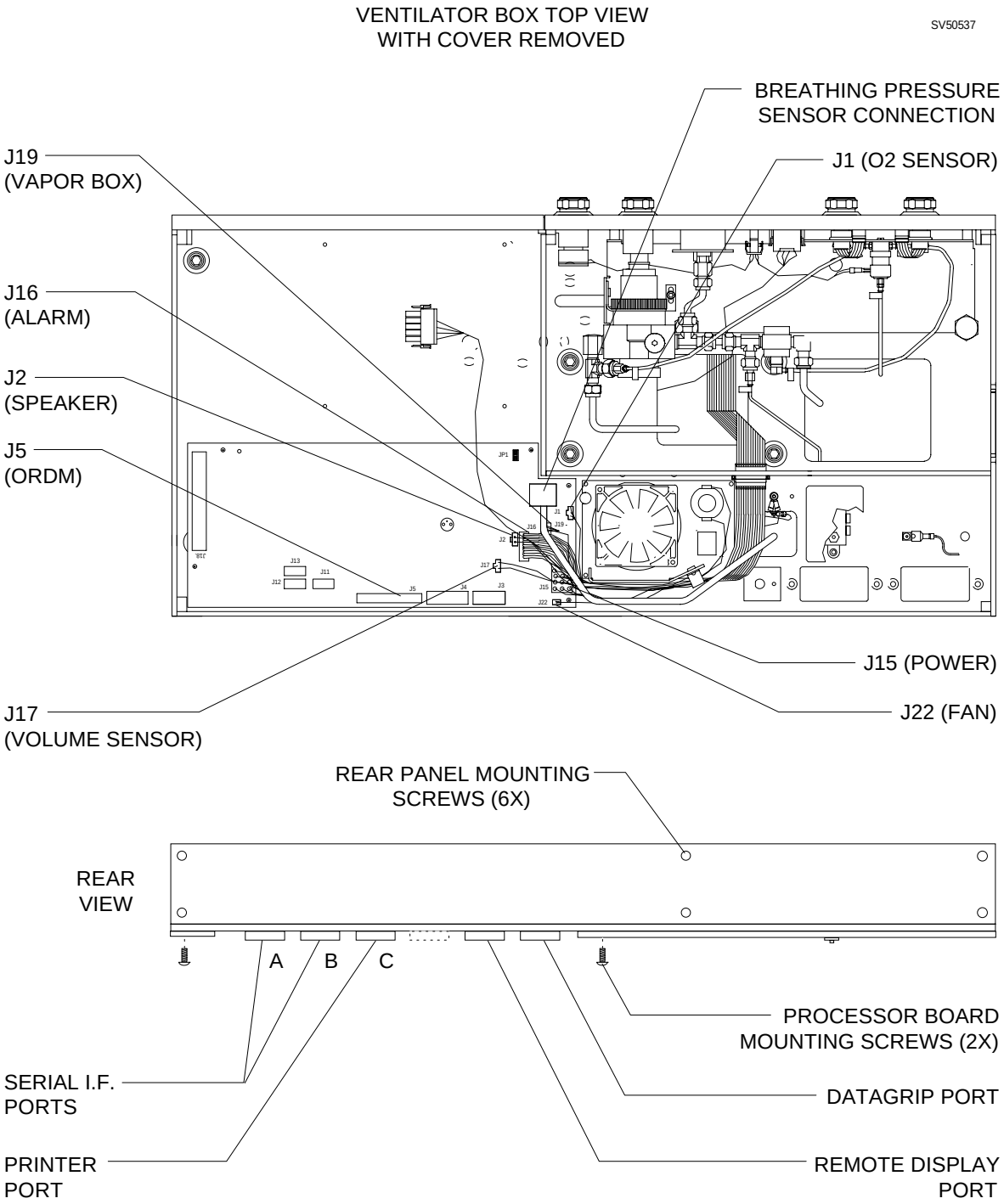

Figure 4-18: PROCESSOR ASSEMBLY

4.18.9 Slide the processor assembly into the ventilator chassis and secure it with the two screws that were previously removed.

4.18.10 Connect the O.R. DATA MANAGER ribbon cable to J5 on the processor board.

4.18.11 Reinstall the back panel of the ventilator box and secure it with the six screws that were previously removed.

4.18.12 Reconnect the Datagrip and remote display cables, and restore any serial interface or printer connections.

4.18.13 Restore power to the machine and observe the Power-Up Diagnostic display (see Section 2) to verify that the replacement processor is working properly.

4.18.14 Access the secondary service screen and enter the machine serial number and vaporizer configuration into memory. Contact the Draeger Medical, Inc. Technical Service Department for access instructions if necessary.

4.18.15 Perform the PMS Procedure given in Section 6.

4.19 Remote Display Assembly

The Remote Display Assembly is mounted on a rod extending from the Datagrip assembly located at the outboard end of the display arm. Figure 4-19 illustrates the Display assembly mounting arrangement.

4.19.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Do not plug or unplug remote display or Datagrip with power applied.

4.19.2 Disconnect the remote display cable from its port on the underside of the ventilator box.

4.19.3 Remove the screws holding the cable clamps along the display arm and separate the cables from the display arm.

4.19.4 Remove the screws holding the cable clamps to the underside of the bellows box and the underside of the ventilator box.

4.19.5 Loosen the display mounting clamp screws (accessible through clearance holes in the back cover of the display).

4.19.6 Cut the tie strap that secures the display cable to the Datagrip cable.

4.19.7 Orient the display with its face toward the floor, or as needed to enable the mounting clamps to slide past the stop pins on the mounting rod, and pull the display from the rod.

4.19.8 Slide the replacement display assembly onto the mounting rod, oriented so that the mounting clamps in the display assembly slide past the stop pins on the rod - until the display is in the correct position on the rod.

4.19.9 Tighten the display mounting clamp screws (accessible through clearance holes in the back cover of the display) until the display has the desired amount of friction on the mounting rod.

4.19.10 Install the remote display and Datagrip cables in the cable clamps that were previously removed, and reinstall their screws along the display arm, bellows box and ventilator box. Ensure that the display arm has full range of motion with no binding caused by the cables.

4.19.11 Install a tie strap to secure the remote display and Datagrip cables together.

4.19.12 Connect the remote display and Datagrip cables to their ports on the underside of the ventilator box.

4.19.13 Restore power to the machine and verify operation of the remote display and Datagrip by exercising the display selections.

4.19.14 Perform the PMS Procedure given in Section 6.

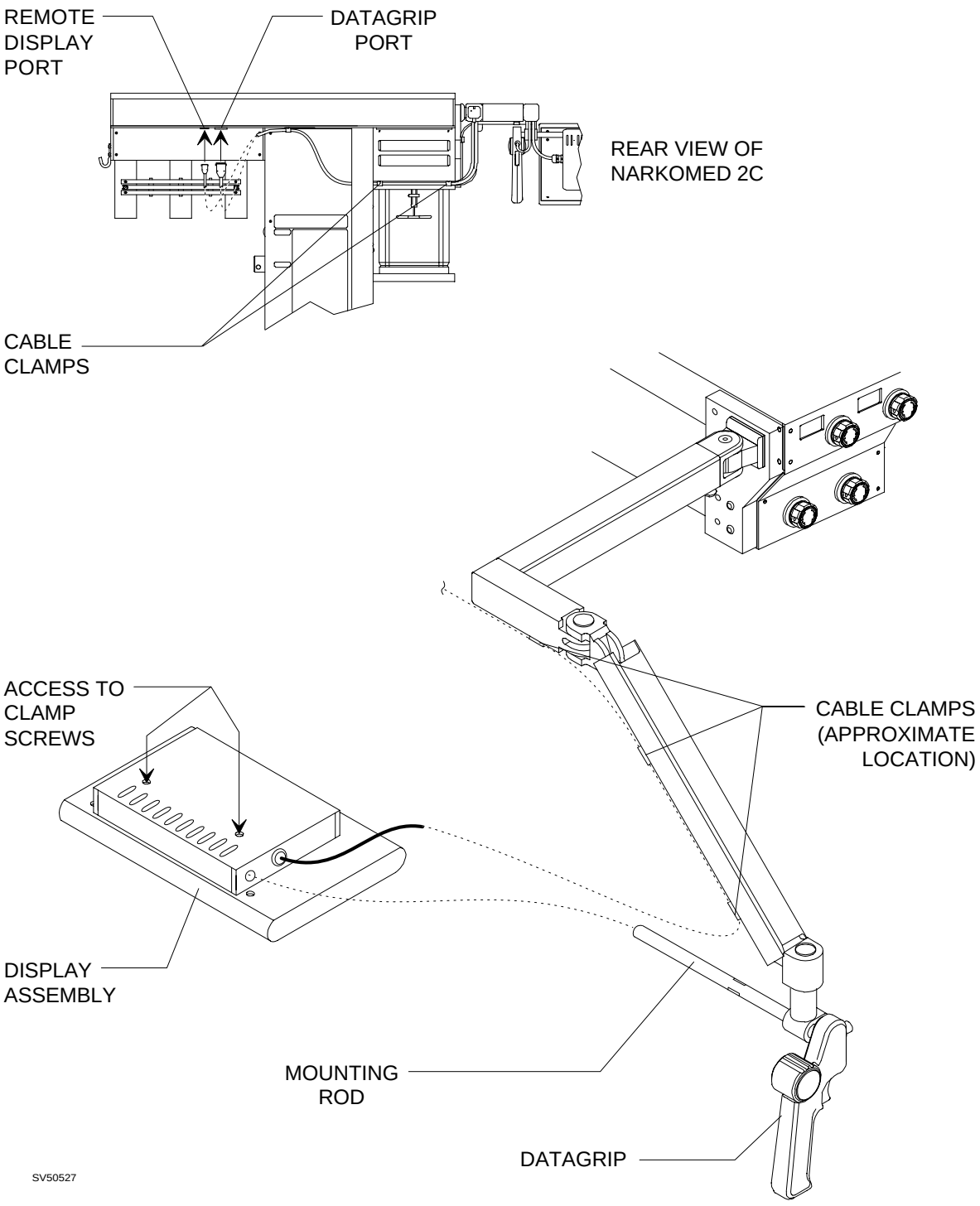

Figure 4-19: REMOTE DISPLAY ASSEMBLY

4.20 DATAGRIP Assembly

The Datagrip Assembly is attached to the outboard end of the display arm and comprises the handle and trigger switch, thumbwheel encoder, cable, and mounting rod for the display. The remote display must be removed from the Datagrip assembly before the assembly is removed from the display arm. (Refer to the illustration (Figure 4-19) accompanying the remote display replacement procedure for details on remote display removal.) Figure 4-20 illustrates the Datagrip assembly mounting arrangement.

4.20.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

CAUTION: Do not plug or unplug remote display or Datagrip with power applied.

4.20.2 Disconnect the Datagrip and remote display cables from their ports on the underside of the ventilator box.

4.20.3 Remove the screws holding the cable clamps along the display arm and separate the cables from the display arm.

4.20.4 Remove the screws holding the cable clamps to the underside of the bellows box and the underside of the ventilator box.

4.20.5 Cut the tie strap that secures the display cable to the Datagrip cable.

4.20.6 Loosen the display mounting clamp screws (accessible through clearance holes in the back cover of the display).

4.20.7 Orient the display with its face is toward the floor, or as needed to enable the mounting clamps to slide past the stop pins on the mounting rod, and pull the display from the rod.

4.20.8 Remove the plastic cap at the end of the display arm to expose the Datagrip assembly mounting screw.

4.20.9 While holding the Datagrip assembly, loosen the mounting screw until the assembly separates from the display arm.

4.20.10 Mount the replacement Datagrip assembly to the display arm and tighten its mounting screw. Reinstall the plastic cap to cover the mounting screw recess.

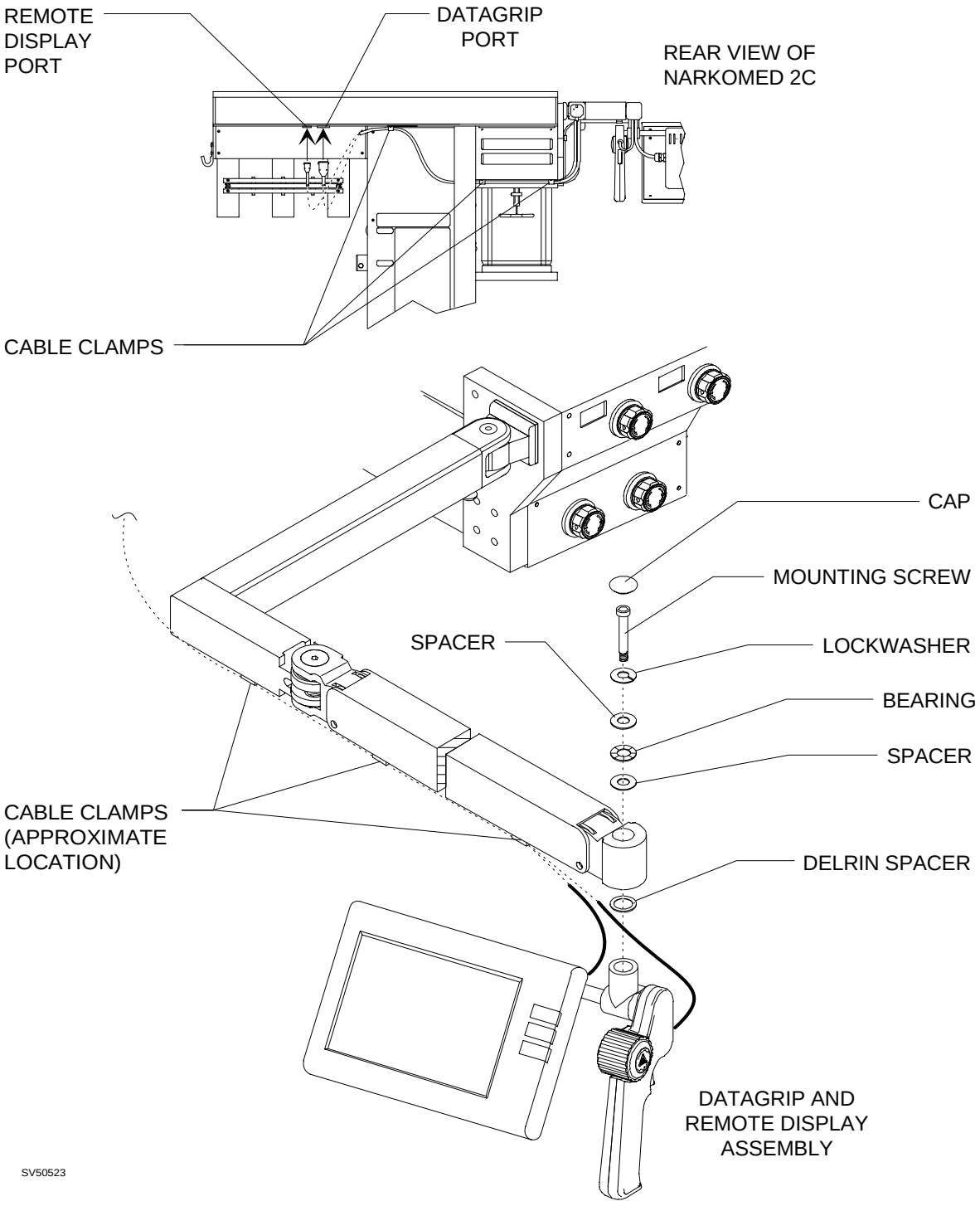

Figure 4-20: DATAGRIP ASSEMBLY

4.20.11 Slide the display onto the mounting rod, oriented so that the mounting clamps in the display assembly slide past the stop pins on the rod - until the display is in the correct position on the rod.

4.20.12 Tighten the display mounting clamp screws (accessible through clearance holes in the back cover of the display) until the display has the desired amount of friction on the mounting rod.

4.20.13 Install the remote display and Datagrip cables in the cable clamps that were previously removed, and reinstall their screws along the display arm, bellows box and ventilator box. Ensure that the display arm has full range of motion with no binding caused by the cables.

4.20.14 Install a tie strap to secure the remote display and Datagrip cables together.

4.20.15 Connect the remote display and Datagrip cables to their ports on the underside of the ventilator box.

4.20.16 Restore power to the machine and verify operation of the remote display and Datagrip by exercising the display selections.

4.20.17 Perform the PMS Procedure given in Section 6.

4.21 Display Arm Assembly

This procedure applies to both the adjustable arm and the short arm.

The display arm assembly includes a support plate that attaches to the left side of the machine with socket head screws that thread into the bellows box and ventilator box. Before removing the display arm from the machine, the Datagrip and remote display assembly must be removed from the outboard end of the arm. Figure 4-21 shows a typical display arm mounting arrangement. Figure 4-21A shows the cable routing arrangement for the adjustable arm, and Figure 4-21B shwos the cable routing arrangement for the short arm.

Refer to Figure 4-21C for installations with an optional patient line boom arm.

4.21.1 Turn the System Power switch to STANDBY.

CAUTION: Do not plug or unplug remote display with power applied.

4.21.2 Disconnect the remote display and Datagrip cables from their ports on the underside of the ventilator box.

4.21.3 Remove the screws holding the cable clamps along the display arm and separate the cables from the display arm.

4.21.4 Remove the screws holding the cable clamps to the underside of the bellows box and the underside of the ventilator box.

4.21.5 Remove the plastic cap at the end of the display arm to expose the Datagrip assembly mounting screw.

4.21.6 While holding the Datagrip assembly, loosen the mounting screw until the assembly separates from the display arm.

WARNING: Do not attempt to disassemble the display arm sections. Release of the internal spring may cause injury to personel.

4.21.7 While holding the display arm, remove the six screws holding its support plate to the side of the machine.

. . . . . .

NOTE: If the replacement display arm hardware was not pre-assembled, refer to Service Procedure SP00114 for assembly details.

4.21.8 Hold the replacement display arm assembly in place and secure the support plate to the machine with the screws that were previously removed. If the machine is equipped with a manual sphygmomanometer, the longer screw is used to secure the gauge mount at the lower front corner of the support plate.

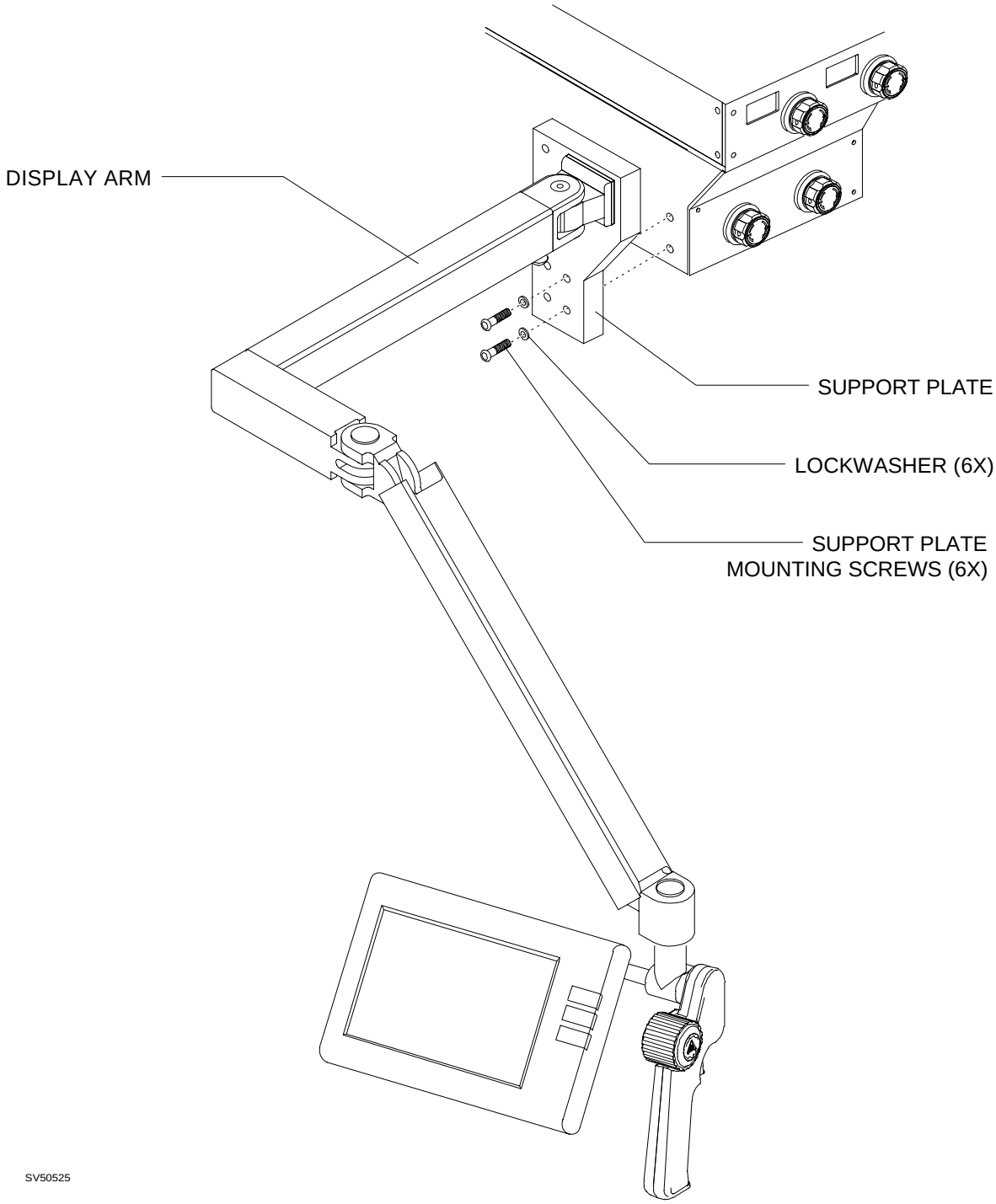

Figure 4-21: DISPLAY ARM

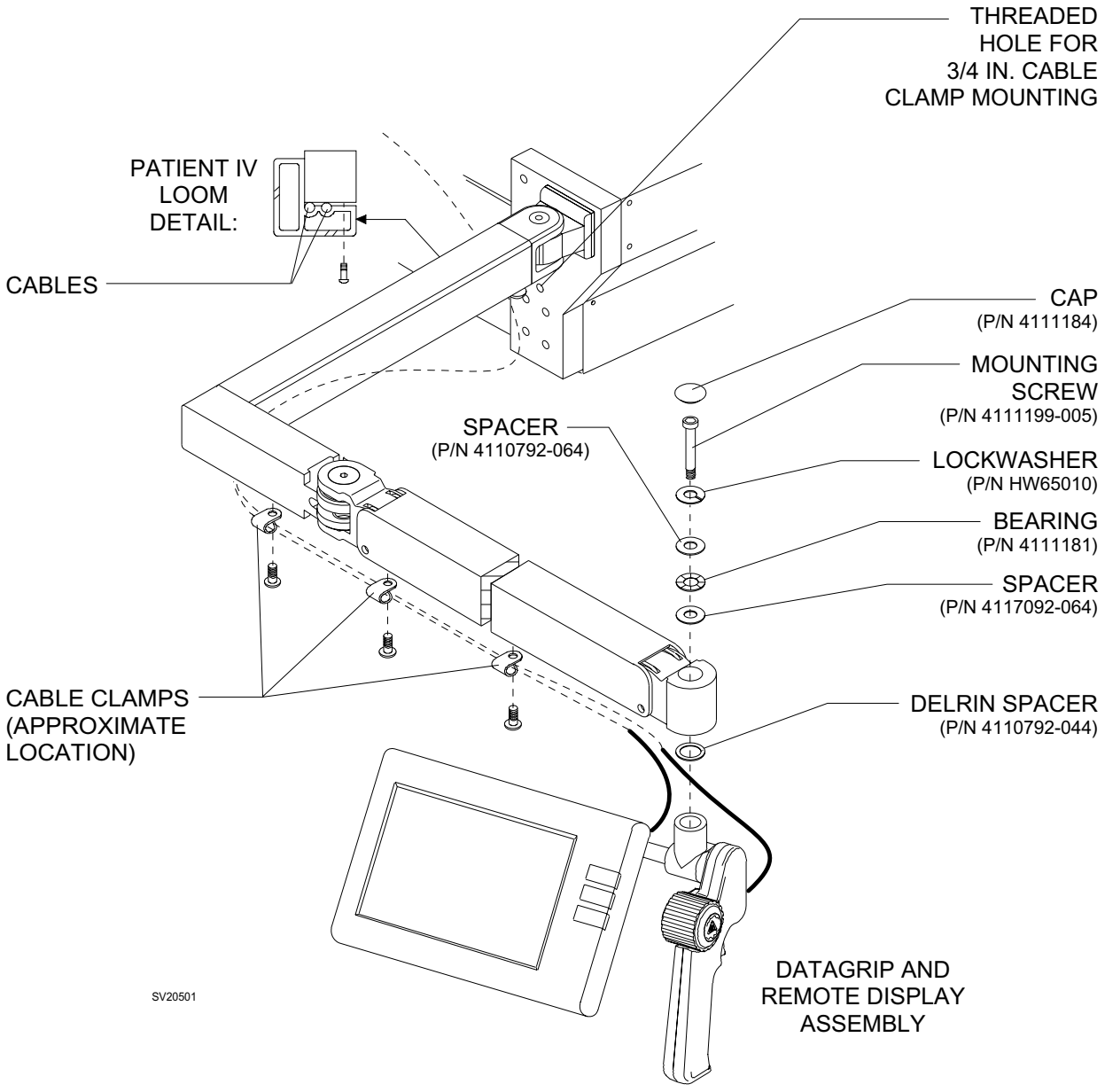

Figure 4-21A: CABLE ROUTING ARRANGEMENT FOR ADJUSTABLE DISPLAY ARM

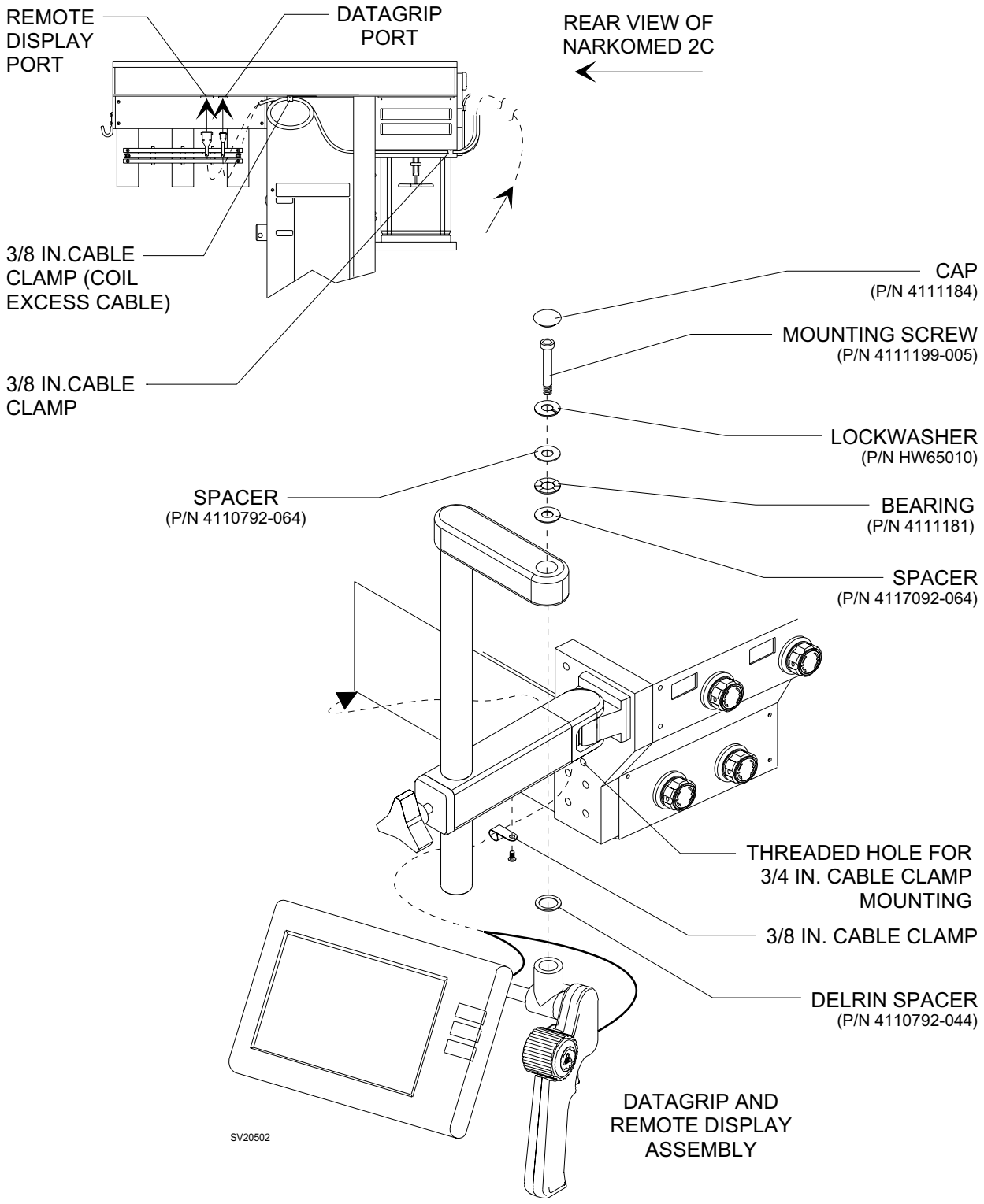

Figure 4-21B: CABLE ROUTING ARRANGEMENT FOR SHORT DISPLAY ARM

4.21.9 Reinstall the Datagrip and remote display assembly to the display arm and tighten its mounting screw to a torque of 4 foot pounds. Replace the plastic cap covering the mounting screw recess.

4.21.10 Route the cables as shown in the applicable illustration. For the adjustable arm, coil the excess cable in the patient IV looms. For the short arm, coil the excess cable in the ¾ in. cable clamp on the underside of the ventilator box.

4.21.11 Connect the remote display and Datagrip cables to their ports on the underside of the ventilator box. Verify that the arm and the Datagrip have full range of motion with no binding caused by the cables. Position the cables in their clamps as needed.

4.21.12 If tension adjustment is needed on the adjustable display arm hinge, refer to the adjustment procedure in Section 5 of this manual.

4.21.13 Restore power to the machine and verify that the Datagrip and remote display are working properly.

4.21.14 Perform the PMS Procedure given in Section 6.

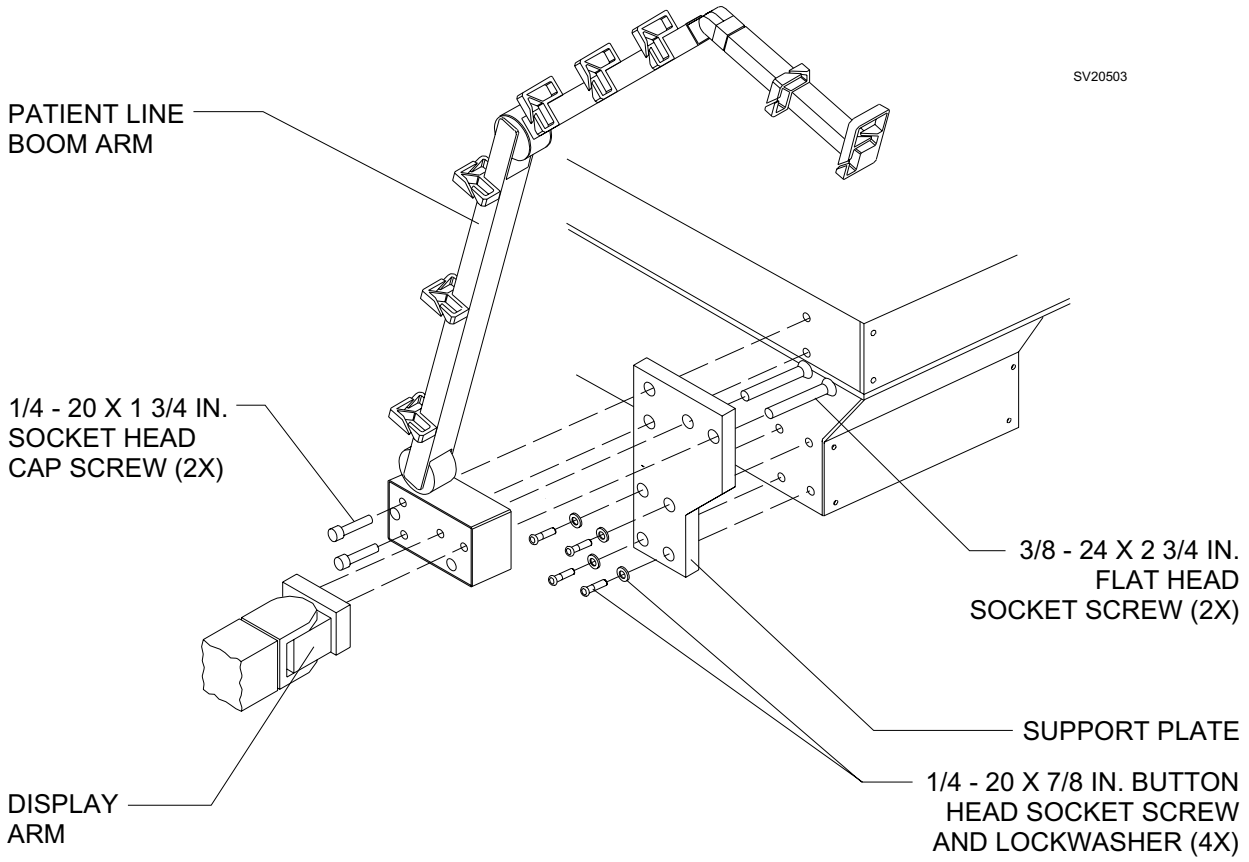

Figure 4-21C: OPTIONAL PATIENT LINE BOOM ARM ASSEMBLY DETAILS

4.22 O.R. DATA MANAGER Sub-Assembly

The O.R. DATA MANAGER (ORDM) Sub-Assembly is located behind the right front ventilator box cover. Replacement of the ORDM requires removal of the ventilator box back panel and disconnecting the ORDM - processor board cable. The ORDM can then be withdrawn from the front of the ventilator box for access to the remaining cables. Figure 4-22 shows the ORDM mounting and cable connection arrangement.

4.22.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.22.2 Remove any disk from the disk drive.

CAUTION: Use ESD protection when handling the ORDM sub-assembly.

4.22.3 Remove the back panel of the ventilator box and disconnect the ribbon cable from J5 on the processor board. Leave the other end of the cable attached to the ORDM assembly.

NOTE: If the machine is equipped with an auxiliary lamp it must be removed before proceeding to the next step.

4.22.4 Remove the two screws securing the right end of the ORDM front bezel.

4.22.5 Pull the right side of the bezel outward, slide it to the right until the locking tab on the left side of the bezel is clear of its receptacle, and remove the bezel.

4.22.6 Loosen the two captive mounting screws securing the ORDM sub-assembly to the ventilator box, then pull the ORDM sub-assembly out far enough to gain access to the remaining connections.

4.22.7 Disconnect the following at the system interface board on the back of the ORDM sub-assembly:

J2: Power Supply Wire Harness
J9: Network Cable
J5: Keyboard Cable (DIN Connector)

The ORDM sub-assembly can now be removed from the ventilator box.

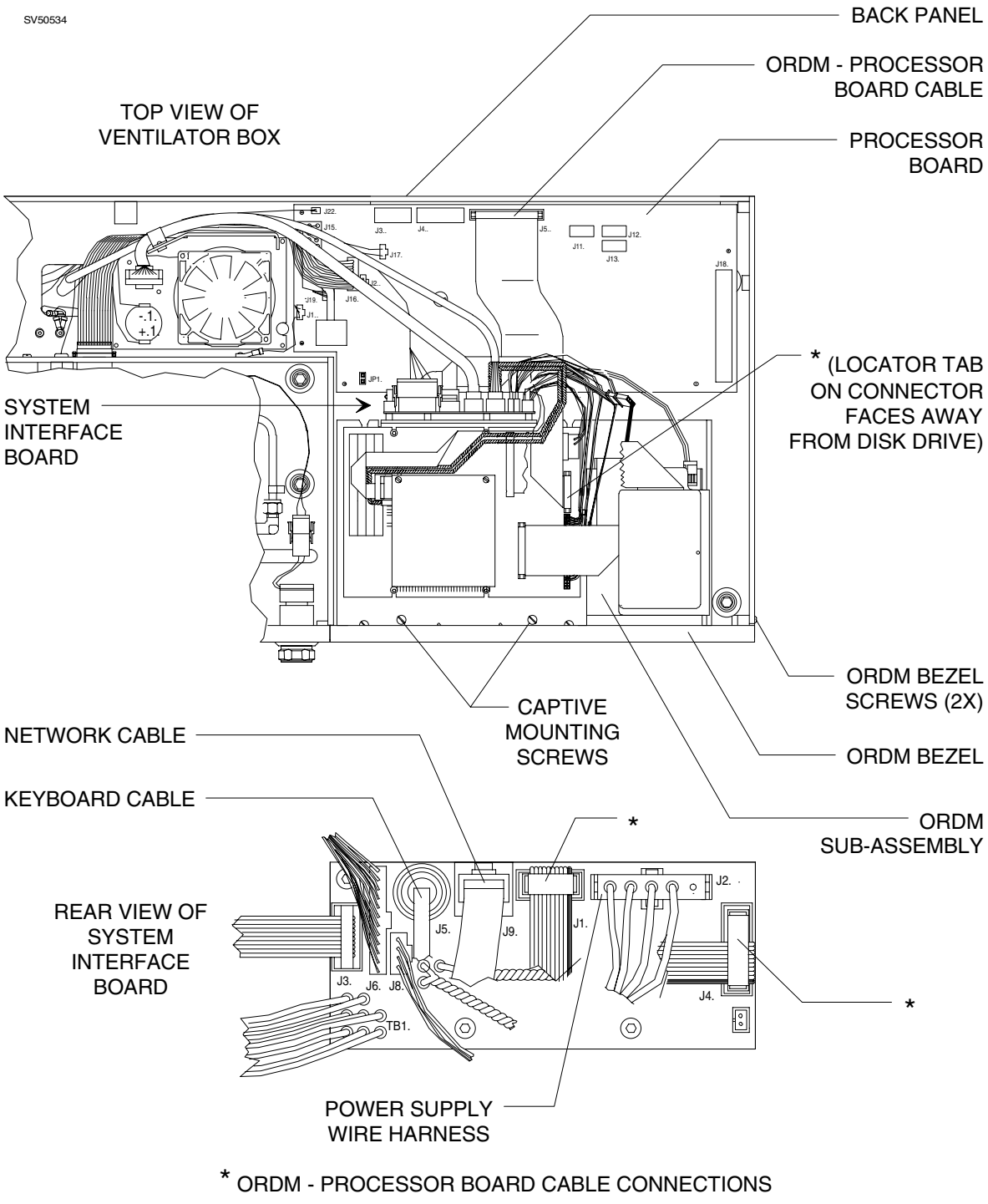

Figure 4-22: O.R. DATA MANAGER

4.22.8 Remove the cable from J1 and J4 on the system interface board (marked (*) in the illustration).

4.22.9 Remove the ORDM - processor board cable from J2/J3 of the ORDM CPU PCB (marked (*) in the illustration).

4.22.10 Reinstall the ORDM - processor board 24 cond. connector on J2/J3 of the ORDM CPU PCB on the replacement ORDM. Ensure that the locator tab on the connector faces away from the disk drive.

4.22.11 Install the 10 cond. connector of the ORDM - processor cable on J1 of the system interface board.

4.22.12 Install the 16 cond. connector of the ORDM - processor cable on J4 of the system interface board.

4.22.13 Position the replacement ORDM sub-assembly in the ventilator box and reconnect the keyboard cable, network cable, and power supply wire harness to the system interface board at the back of the ORDM sub-assembly.

4.22.14 Slide the assembly into into the ventilator box. Tighten the captive mounting screws to attach the ORDM sub-assembly to the ventilator box.

4.22.15 Carefully fit the locking tab on the left side of the bezel into its receptacle, then slide the bezel to the left until it is properly seated.

4.22.16 Reinstall the two retaining screws at the right side of the bezel.

(Reinstall the auxiliary lamp at this time, if applicable.)

4.22.17 At the back of the ventilator box, connect the ORDM - processor board ribbon cable to J5 on the processor board, and replace the ventilator box back panel with the screws that were previously removed.

4.22.18 Insert the O.R. DATA MANAGER Program Disk into the disk drive. Restore power to the machine and turn the System Power switch to ON.

4.22.19 Follow the ORDM boot information that appears on the Remote Display.

4.22.20 Perform the PMS Procedure given in Section 6.

4.23 Keyboard

The keyboard is mounted on a pull-out tray assembly located just below the table top of the anesthesia equipment cabinet. The keys are covered by a polyurethane shield formed to fit over the keys. This shield is held in place by a self-adhesive strip around its perimeter and can be replaced without removing the keyboard from the tray. Figure 4-23 shows the keyboard assembly sequence. Following are the steps needed for removal and replacement of the keyboard.

4.23.1 Set the System Power switch to STANDBY.

4.23.2 Pull the keyboard tray out to its fully extended position, and carefully remove the polyurethane shield by separating its adhesive perimeter from the keyboard faceplate.

4.23.3 Remove the four faceplate retaining screws.

4.23.4 Remove the three drawer lip retaining screws and lift the faceplate from the keyboard.

4.23.5 Disconnect the cable from the keyboard and carefully lift the keyboard from the pull-out tray.

4.23.6 Carefully lower the replacement keyboard into the pull-out tray and connect the cable.

4.23.7 Place the faceplate over the keyboard and install the four faceplate retaining screws.

4.23.8 Install the three drawer lip retaining screws.

4.23.9 Test the movement of all keys to ensure that none are sticking. If any are found to be sticking, loosen the four faceplate retaining screws and the three drawer lip retainer screws, and reposition the faceplate. Tighten all screws and retest the key action.

4.23.10 Fit a new polyurethane shield over the keys and press its adhesive perimeter firmly onto the faceplate.

4.23.11 Perform the PMS procedure given in Section 6.

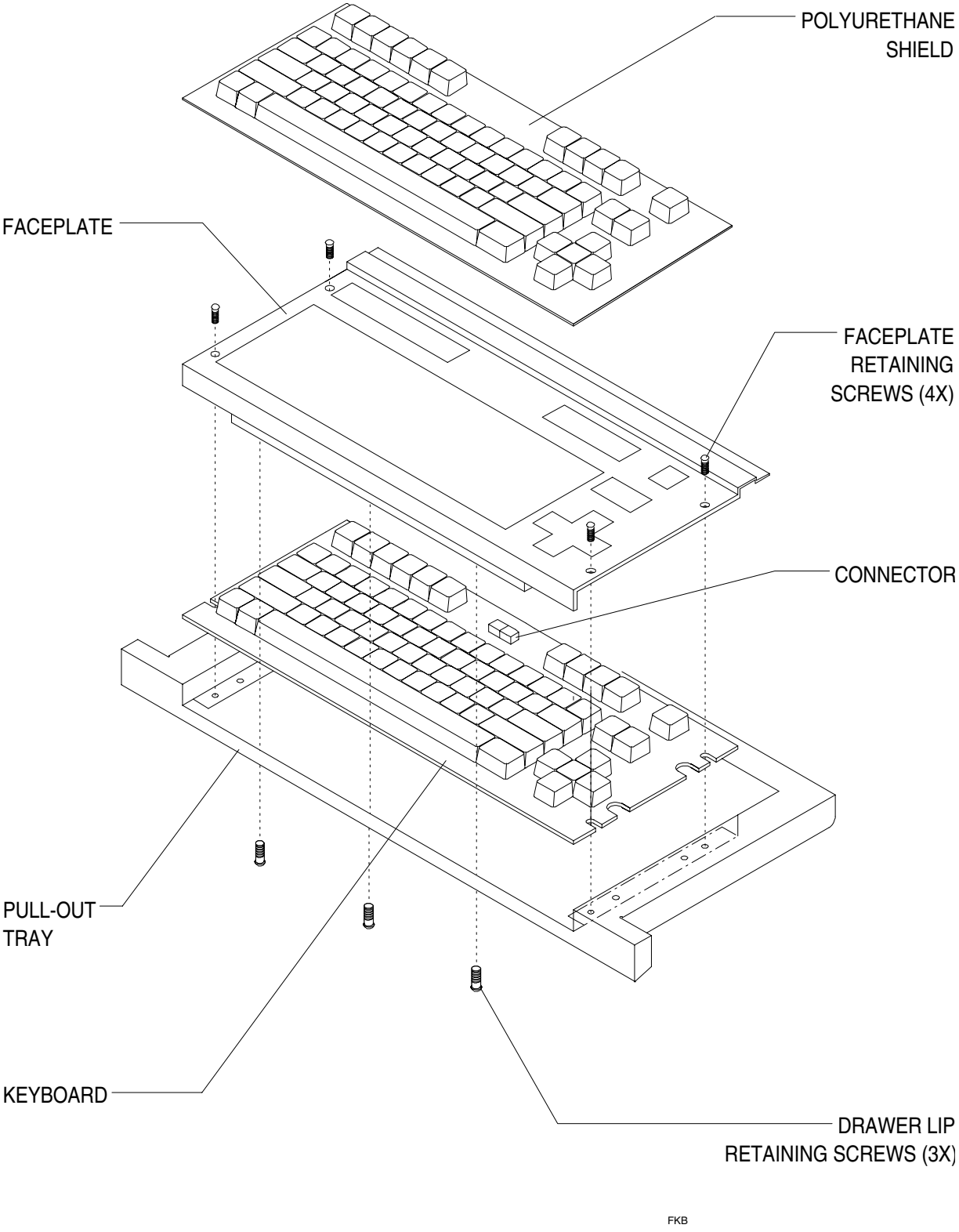

Figure 4-23: KEYBOARD ASSEMBLY

4.24 SPIROMED Respiratory Volume Sensor

The respiratory volume sensor is installed between the top of the absorber assembly and the expiratory valve. Figure 4-24 shows the volume sensor mounting and gasket arrangement, and connection to the sensor interface panel.

4.24.1 Set the System Power switch to STANDBY.

4.24.2 Disconnect the sensor plug from the volume sensor receptacle on the sensor interface panel.

4.24.3 Remove the expiratory valve by unscrewing the valve retaining nut.

4.24.4 Remove the volume sensor from the absorber assembly by unscrewing its retaining nut.

CAUTION: Do not twist the body of the sensor when loosening the retaining nut. Hold the sensor while loosening the retaining nut to prevent damage to the unit.

4.24.5 Install the replacement volume sensor on the absorber assembly. Ensure that the gasket is seated properly and hand tighten the retaining nut.

4.24.6 Install the expiratory valve on the sensor. Ensure that the gasket is seated properly and hand tighten the valve retaining nut.

4.24.7 Connect the sensor plug to the volume sensor receptacle on the sensor interface panel.

4.24.8 Restore power to the machine and perform the respiratory flow monitor calibration procedure given in Section 5.

4.24.9 Perform the PMS Procedure given in Section 6.

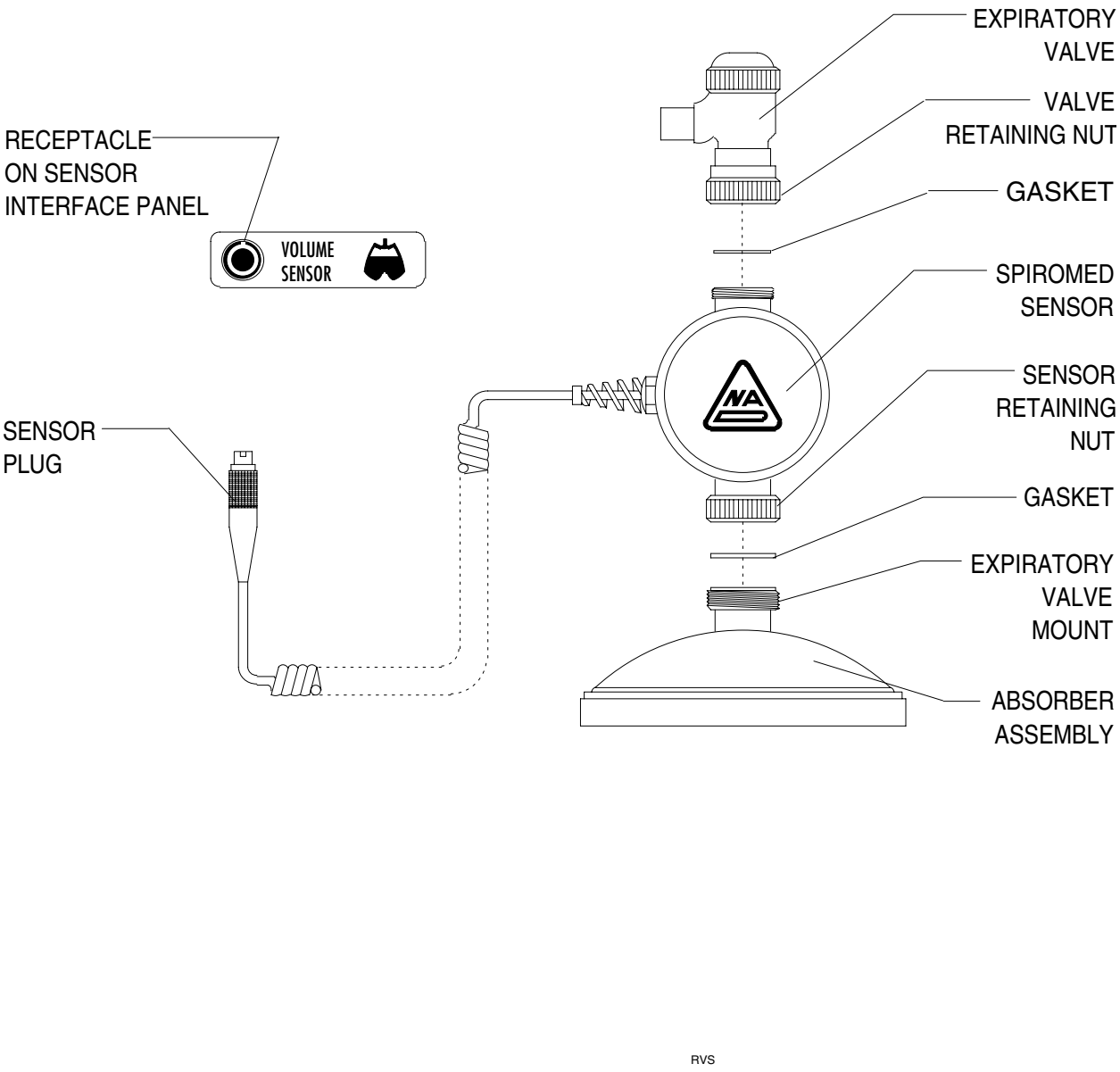

Figure 4-24: RESPIRATORY VOLUME SENSOR

4.25 Oxygen Sensor

The oxygen sensor is located on top of the inspiratory valve. Figure 4-25 shows the arrangement of the sensor capsule and its housing, and also its connection to the sensor interface panel.

4.25.1 Set the System Power switch to STANDBY.

4.25.2 Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press fit.)

4.25.3 Unscrew the cover from the sensor housing and remove the sensor capsule.

4.25.4 Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

4.25.5 Wait 15 minutes to allow the sensor capsule to stabilize.

4.25.6 Restore power to the machine and perform the 21% calibration procedure for the oxygen monitor given in Section 5.

4.25.7 Press the sensor assembly into the inspiratory valve dome.

4.25.8 Perform the PMS Procedure given in Section 6.

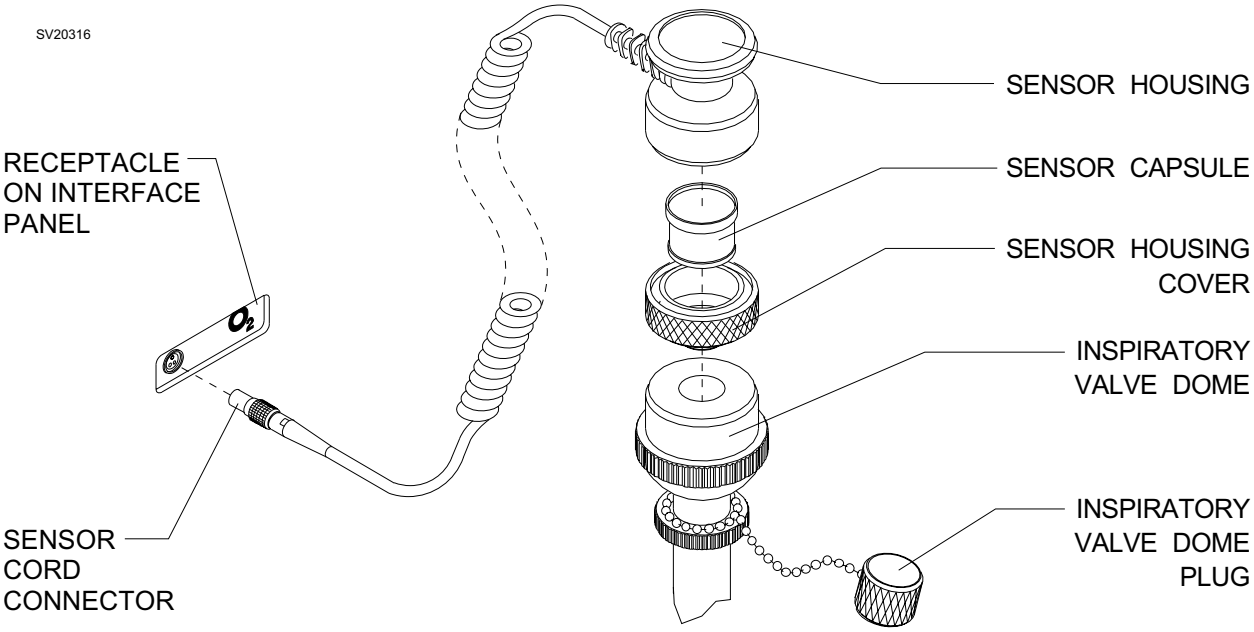

Figure 4-25: OXYGEN SENSOR REPLACEMENT

4.26 Auxiliary Oxygen Flow Meter

Old and new style auxiliary oxygen flowmeters are attached to the side of the machine's flowmeter housing by two screws - accessible from inside the housing. Later installations of the new style auxiliary oxygen flowmeter have a stud and nut arrangement for mounting. A flexible O_2 supply tube from the flowmeter connects to a hose barb fitting at the system power switch. Figure 4-26 shows a typical mounting and tubing arrangement.

4.26.1 Disconnect all pipeline hoses and close all cylinder valves.

4.26.2 Press the O_2 Flush button to drain oxygen pressure from the system.

4.26.3 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.26.4 Remove the back cover from the flowmeter housing.

4.26.5 Cut the tie strap on the flexible tube at the system power switch, and remove the tube.

4.26.6 Remove the screws (or nuts) securing the auxiliary O_2 flowmeter, and remove the flowmeter.

4.26.7 Position the replacement flowmeter at the side of the flowmeter housing (feed the flex tubing through the clearance hole) and secure the auxiliary O_2 flowmeter with the two screws (or nuts) that were previously removed.

4.26.8 Connect the flex tubing to the hose barb fitting behind the Clippard valve, and secure it with a tie strap.

4.26.9 Reinstall the flowmeter housing back cover.

4.26.10 Connect the pipeline hoses and restore AC power to the machine.

4.26.11 Perform the PMS Procedure given in Section 6.

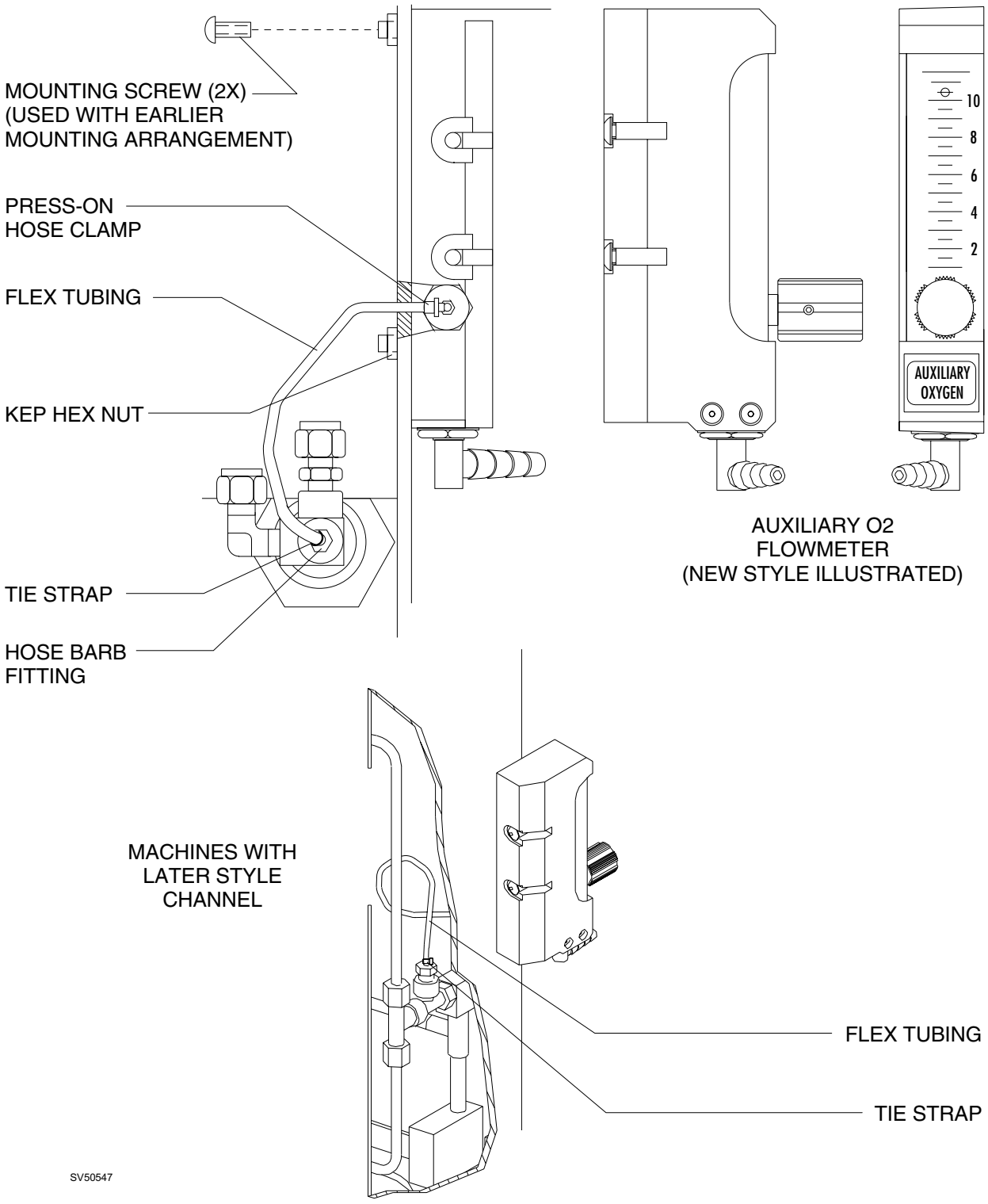

Figure 4-26: AUXILIARY O_2 FLOWMETER

4.27 PEEP Valve Magnet Assembly Replacement

The PEEP valve magnet assembly removal and replacement is outlined in the following procedure. Figure 4-33 shows the knob and magnet assembly details.

NOTE: Some older PEEP valve assemblies require the use of a tamper-proof 5/56 hex key (P/N S010056).

4.27.1 Loosen the two set screws on the block, at each side of the PEEP knob using a 5/64 hex key. Back these screws out until they are flush with the block to allow proper removal of the knob assembly.

4.27.2 Using a flat head screw driver, carefully pry the knob and magnet assembly away from the block, and remove the assembly.

4.27.3 Remove the four or six screws securing the retaining ring on the knob and magnet assembly, and remove the retaining ring.

4.27.4 Remove the magnet assembly from the knob and discard the magnet in an appropriate manner.

4.27.5 Insert the new magnet assembly into the knob.

On new style knobs, make sure the magnet's dowel pin engages the slots in the knob. If the magnet is not oriented correctly there will be freeplay in the knob before it turns the magnet.

4.27.6 Reinstall the retaining ring and secure it with the screws that were previously removed.

4.27.7 Turn the set screws into the PEEP block until you can just see them from the inside of the block.

4.27.8 Apply a thin coat of high vacuum grease to the O-rings on the magnet assembly to aid in its installation.

4.27.9 Align the holes of the magnet assembly with the set screw holes, and install the knob & magnet assembly into the PEEP block.

4.27.10 Slowly tighten the set screws. If the holes are lined up correctly. you will be able to tighten the set screws several turns until they stop. If you experience resistance, STOP tightening the set screw to prevent damage to the magnet assembly. Re-align the magnet assembly and tighten the set screw correctly.

4.27.11 Perform the PMS procedure given in Section 6.

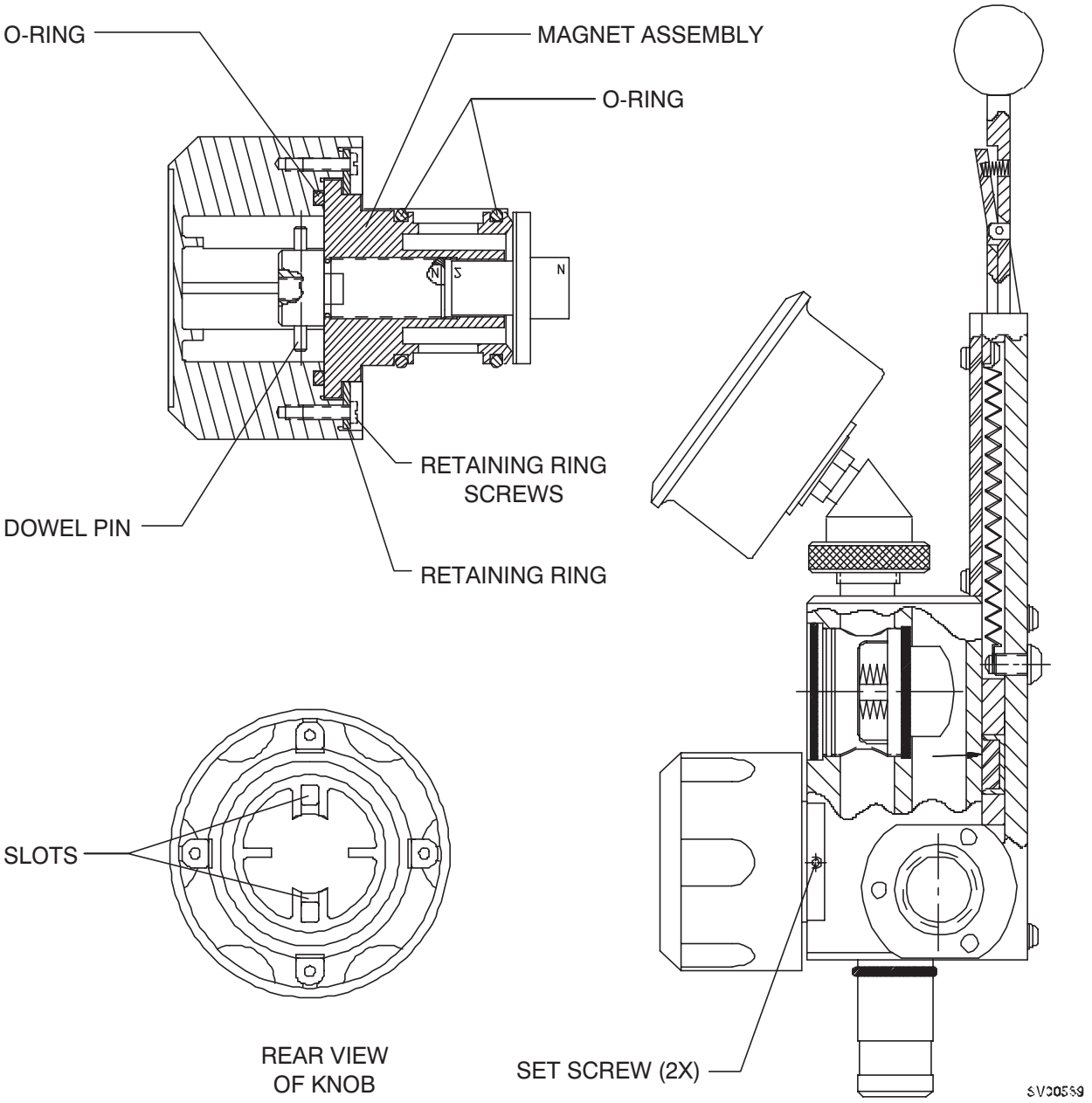

Figure 4-27: PEEP Valve Magnet Assembly Replacement

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
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5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

-- Test Gauge for setting cylinder pressure regulators,
NAD Part No. S000063A

-- Oxygen Monitor for adjusting Oxygen Ratio Controller

-- Test fixture with breathing pressure line connector, TEE connector, gauge, and inflation device, for breathing pressure monitor calibration

-- 7/64 in. hex wrench for display arm friction adjustment.

5.1 Cylinder Pressure Regulator Adjustment (except CO2)

5.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.1.2 Close all cylinder valves except the O_2 valve.

5.1.3 Set the oxygen flow to 4 liters per min.

5.1.4 Open the other gas flow control valves to drain pressure from the system.

5.1.5 Close the O2 cylinder valve. Close all of the flow control valves and press the O_2 Flush valve to drain oxygen pressure from the system.

5.1.6 Set the System Power switch to STANDBY.

5.1.7 Remove the table top from the machine and remove the top cabinet drawer. Pull the writing tray out out to its fully extended position.

NOTE: Minimum cylinder pressures for this adjustment shall be:
N2O & CO2: 600 psi; O2, Air, He, He/O2, N2: 1000 psi.

5.1.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.1.9 Connect a test gauge to the TEE fitting.

NOTE: For gases other than O2, the O2 cylinder valve must be open to allow other gases to flow. For N2O regulator adjustment, open the N2O flow control valve completely; then open the O2 flow control valve until the N2O flow reaches 4 L/min.

5.1.10 Open the cylinder valve and set the System Power switch to ON.

5.1.11 Set the O2 flow to 4 L/min. (also set the N20 or other gas flow to 4 L/min. if these regulators are being adjusted).

5.1.12 Remove the acorn nut on the bottom of the regulator to expose the adjusting screw. For N2O, turn the screw until the test gauge indicates 46 psi. (50 psi for CSA machines.) For O2 and other gases, use the compensated regulator output setting based on the cylinder pressure given in the following table.

CAUTION: Based on information supplied by the cylinder regulator manufacturer, when the regulator is used for gases other than N2O or CO2, its output pressure will decrease 0.5 psi for every 100 psi increase in cylinder pressure above 1000 psi. Currently, these regulators are calibrated at 47 psi with a cylinder supply of 1000 psi. If a 2000 psi cylinder is then installed, the regulator output will be 42 psi. This change in output must be compensated for to provide accurate performance throughout the cylinder's working range.

NOTE: Cylinder pressure compensation for the N2O regulator is not required.

Cylinder Pressure (psi)	Compensated Regulator Output Setting (psi)	Compensated Regulator Output Tolerances (-4, +2)
2000	42 (*45)	38 - 44 (*41 - 47)
1800	43 (*46)	39 - 45 (*42 - 48)
1600	44 (*47)	40 - 46 (*43 - 49)
1400	45 (*48)	41 - 47 (*44 - 50)
1200	46 (*49)	42 - 48 (*45 - 51)
1000	47 (*50)	43 - 49 (*46 - 52)

* Canada Settings

NOTE: If the O2 cylinder regulator is adjusted according to the chart, perform the following test to verify that the Lo O2 supply alarm is not activated during ventilation.

Open the O2 cylinder valve, install a breathing circuit with test lung to absorber, and make the following settings:

MAN/AUTO selector to AUTO

Ventilator:
FREQUENCY: 10 BPM
I:E Ratio: 1:2
Tidal Volume: 1400 mL
PLC: MAX
INSP FLOW: HIGH

Set the Fresh Gas flow to 10 L/min.

Turn on the ventilator. While the ventilator is cycling, press the O2 flush button and verify that the Lo O2 Supply alarm is not activated. If the alarm is activated, refer to Section 5.2 for Oxygen Supply Pressure Alarm Switch Adjustment.

5.1.13 Replace the acorn nut on the bottom of the regulator.

5.1.14 Close the cylinder valve and allow pressure to drain from the system.

5.1.15 Close all of the flow control valves and set the System Power switch to STANDBY.

5.1.16 Disconnect the test gauge from the TEE fitting and replace the plug in the fitting.

5.1.17 Replace the table top and its retaining screws.

5.1.18 Replace the top drawer in the cabinet.

5.1.19 Connect the pipeline hoses.

5.1.20 Perform the PMS Procedure given in Section 6.

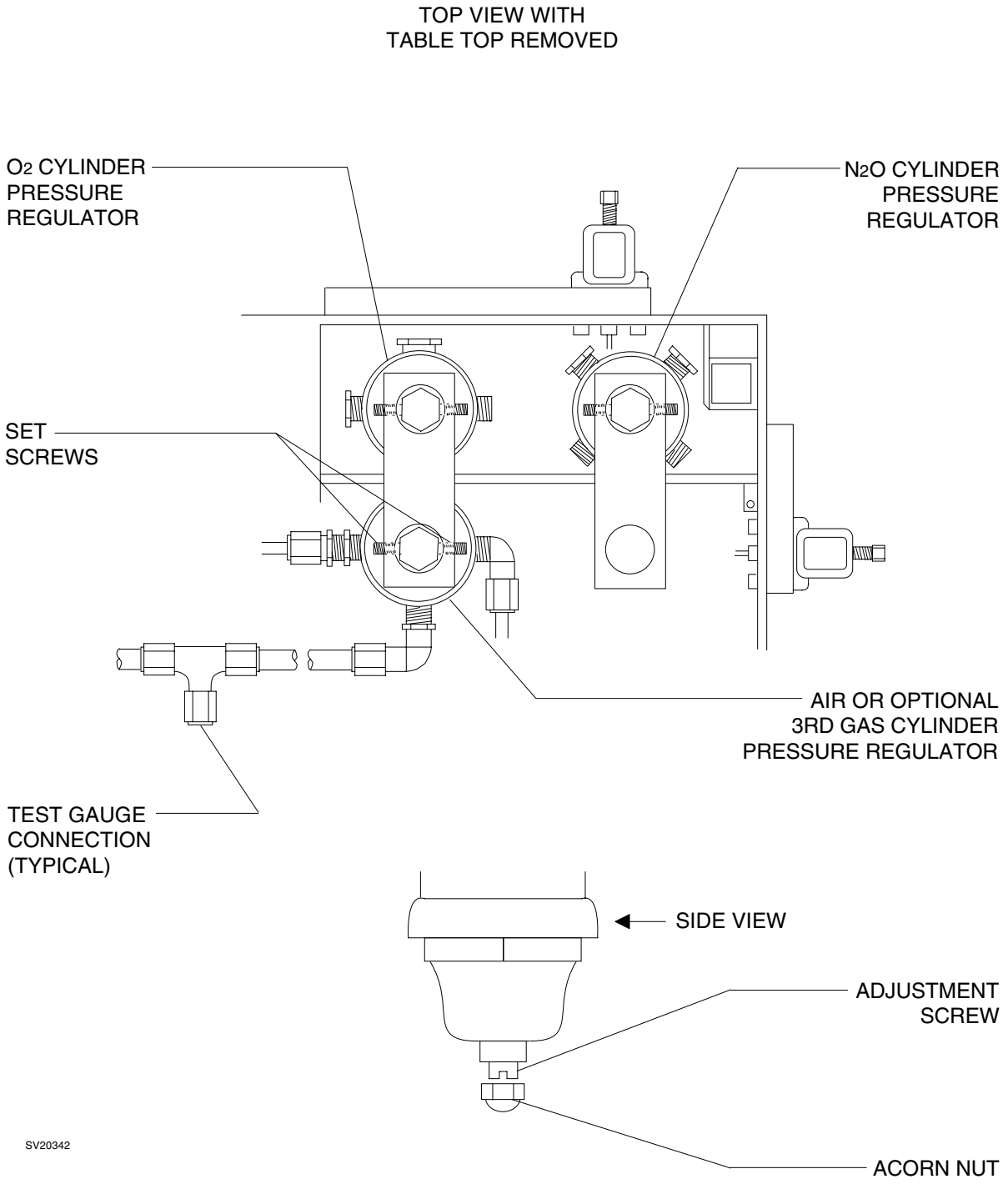


Figure 5-1: CYLINDER PRESSURE REGULATOR ADJUSTMENT

5.1A CO2 Cylinder Pressure Regulator Adjustment

5.1.1.A Perform Steps 5.1.1 thru 5.1.7.

5.1.2.A Open the CO_2 cylinder valve and set the System Power switch to ON.

5.1.3.A Fully open the CO_2 flow control valve.

5.1.4.A Remove the acorn nut on the bottom of the CO_2 regulator to expose the adjusting screw. Turn the screw until the CO_2 flowmeter indicates 550 ml/min.

5.1.5.A Replace the acorn nut on the bottom of the regulator.

5.1.6.A Close the cylinder valve and allow pressure to drain from the system.

5.1.7.A Close the flow control valve and set the System Power switch to STANDBY.

5.1.8.A Replace the table top and its retaining screws.

5.1.9.A Replace the top drawer in the cabinet.

5.1.10.A Connect the pipeline hoses.

5.1.11.A Perform the PMS Procedure given in Section 6.

5.2 Oxygen Supply Pressure Alarm Switch Adjustment

5.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.2.2 Close all cylinder valves except the O_2 valve.

5.2.3 Set the oxygen flow to 5 liters per min.

5.2.4 Open the other gas flow control valves to drain pressure from the system.

5.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.2.6 Set the System Power switch to STANDBY.

5.2.7 Remove the rear cover from the flowmeter housing. Remove the table top and pull the writing or keyboard tray out to its fully extended position.

5.2.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.2.9 Connect a dedicated O_2 test gauge to the TEE fitting.

5.2.10 Open the O_2 cylinder valve and set the System Power switch to ON.

5.2.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

5.2.12 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.2.13 If the alarm activates when the pressure is below 34 psi or above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

5.2.14 Turn the System Power switch to STANDBY.

5.2.15 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

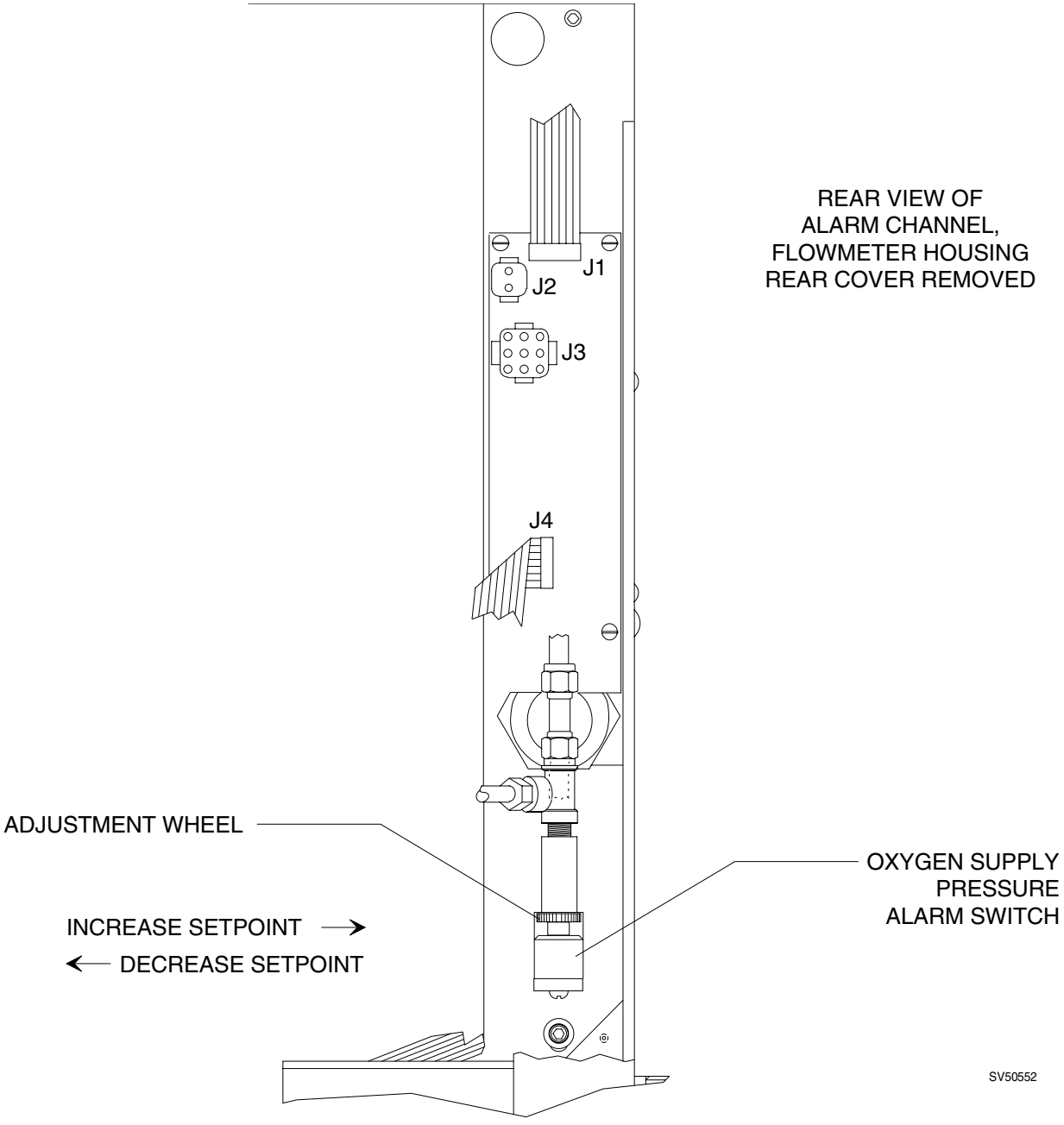


Figure 5-2: OXYGEN SUPPLY PRESSURE ALARM SWITCH

5.2.16 Replace the table top and its retaining screws.

5.2.17 Replace the rear cover and its retaining screws.

5.2.18 Connect the pipeline hoses.

5.2.19 Perform the PMS Procedure given in Section 6.

5.3 Oxygen Ratio Controller (ORC) Adjustment

NOTE: See Procedure 5.3A for low flow ORC (P/N 4113229) adjustment.

5.3.1 Remove the rear cover of the flowmeter housing.

5.3.2 Connect a calibrated oxygen monitor to the fresh gas outlet.

5.3.3 Disconnect the pipeline hoses.

5.3.4 Open the oxygen and nitrous oxide cylinder valves.

5.3.5 Set the System Power switch to ON.

5.3.6 Close the O_2 and N_2O flow control valves.

5.3.7 Set the O_2 flow control valve to 10 l/min.

5.3.8 Set the N_2O flow control valve to 10 l/min.

5.3.9 Set the O_2 flow control valve to 800 ml/min for one (1) minute. Verify that the O_2 concentration indicates 21% to 29% O_2.

5.3.10 Decrease the oxygen flow rate.

5.3.11 If the nitrous oxide does not stop when the oxygen flow is between 325 and 350 ml per minute, loosen the adjusting screw locknut and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow). Tighten the locknut.

5.3.12 Repeat steps 5.3.6 thru 5.3.11 until no further adjustment is needed.

5.3.13 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

5.3.14 The oxygen concentration should be between 21% and 29% oxygen.

5.3.15 Slowly decrease the oxygen flow to 800 ml/min. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.3.16 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

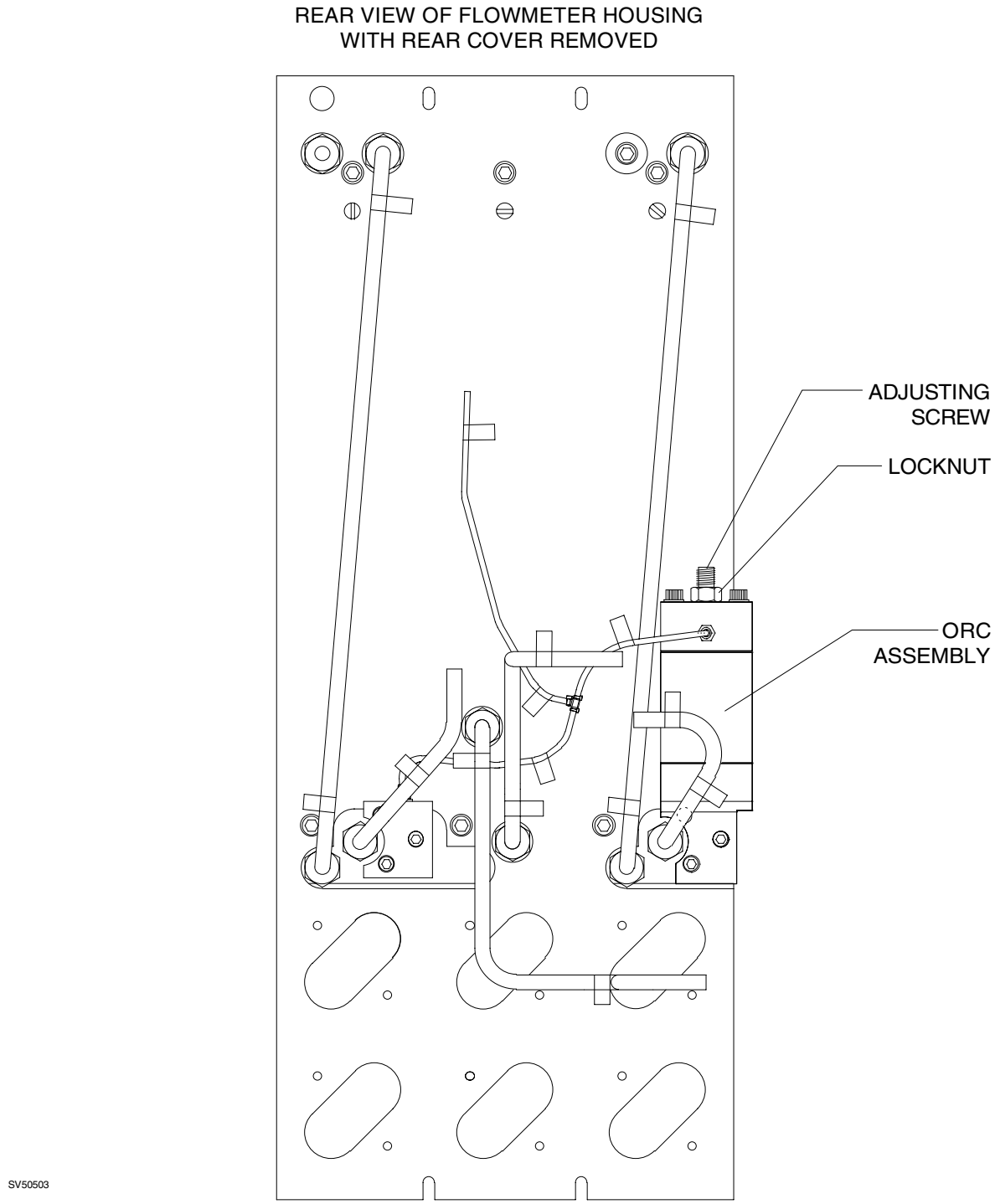


Figure 5-3: OXYGEN RATIO CONTROLLER

5.3.17 The nitrous oxide flow should stop when the flow of oxygen is between 250 and 400 ml per minute.

5.3.18 Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.3.19 Reconnect the pipeline hoses.

5.3.20 Replace the flowmeter housing rear cover.

5.3.21 Perform the PMS Procedure given in Section 6.

5.3A Low Flow Oxygen Ratio Controller (ORC) Adjustment

5.3.1A Remove the rear cover of the flowmeter housing.

5.3.2A Connect a calibrated oxygen monitor to the fresh gas outlet.

5.3.3A Disconnect the pipeline hoses.

5.3.4A Pinch the N_2O bypass line on the ORC. See Figure 5-3A.

5.3.5A Open the oxygen and nitrous oxide cylinder valves.

5.3.6A Set the System Power switch to ON.

5.3.7A Close the O_2 and N_2O flow control valves.

5.3.8A Set the O_2 flow control valve to 10 l/min.

5.3.9A Set the N_2O flow control valve to 10 l/min.

5.3.10A Set the O_2 flow control valve to 800 ml/min for one (1) minute. Verify that the O_2 concentration indicates 21% to 29% O_2.

5.3.11A Decrease the oxygen flow rate.

5.3.12A If the nitrous oxide flow does not stop when the oxygen flow rate is between 325 and 350 ml per minute, loosen the adjusting screw locknut and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow). Tighten the locknut.

5.3.13A Repeat steps 5.3.7A thru 5.3.12A until no further adjustment is needed.

5.3.14A Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

5.3.15A The oxygen concentration should be between 21% and 29% oxygen.

5.3.16A Slowly decrease the oxygen flow to 800 ml/min. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.3.17A Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

5.3.18A The nitrous oxide flow should stop when the flow of oxygen is between 250 and 400 ml per minute.

5.3.19A Un-pinch the N_2O bypass line on the ORC.

5.3.20A Close the O_2 flow control valve, and fully open the N_2O flow control valve. Verify that the O_2 concentration is 22 - 31%.

5.3.21A Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.3.22A Reconnect the pipeline hoses.

5.3.23A Replace the flowmeter housing rear cover.

5.3.24A Perform the PMS Procedure given in Section 6.

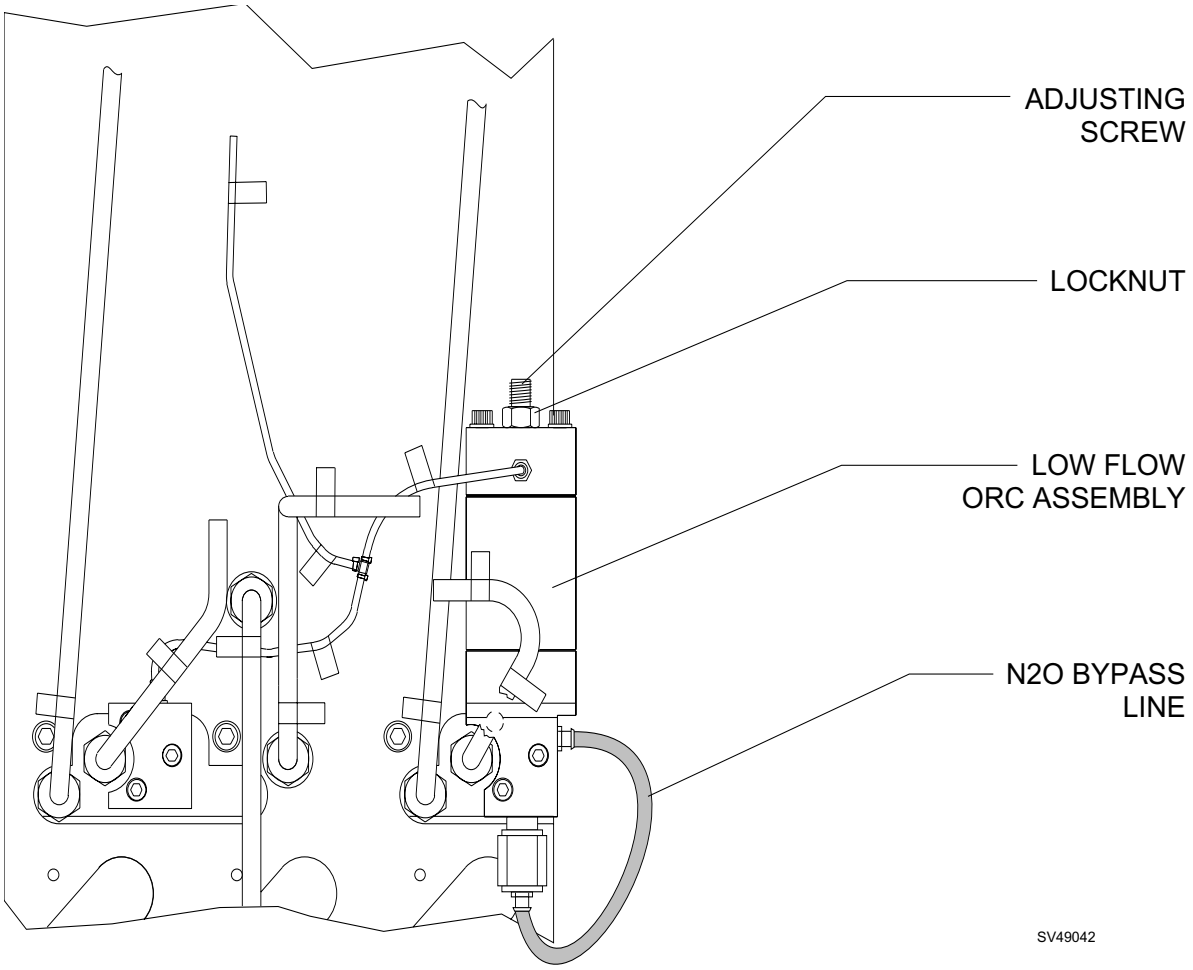


Figure 5-3A: LOW FLOW OXYGEN RATIO CONTROLLER

5.4 Display Arm Tension Adjustments

5.4.1 Display Arm Hinge Adjustment:

5.4.1.1 Loosen the friction adjustment screw on the underside of the display arm (no more than one turn). (It may be necessary to raise or lower the arm to align the screw with the access hole.) See Figure 5-4.

5.4.1.2 Raise and release the arm, and verify that it returns to an approximately horizontal position.

Lower and release the arm, and verify that it returns to an approximately horizontal position.

Contact the NAD Service Department if the display arm fails to return to a near-horizontal position.

5.4.1.3 With the arm in a horizontal position, slowly re-tighten the friction adjustment screw until the arm stays in position when raised or lowered. (Do not over-tighten the screw as this will cause the arm to loose tension in the raised position.)

5.4.2 Machine Mount Joint:

5.4.2.1 If there is excessive free swing at the machine mount joint, tighten the shoulder screw shown in the illustration. The correct torque setting is 75 in. lbs.

5.4.3 Datagrip and Remote Display Assembly Torque Adjustment:

5.4.3.1 Remove the plastic cap at the end of the display arm to expose the remote display assembly mounting screw.

5.4.3.2 While holding the remote display assembly, tighten the mounting screw to a torque of 3 to 5 foot pounds.

5.4.3.3 Replace the plastic cap at the end of the display arm.

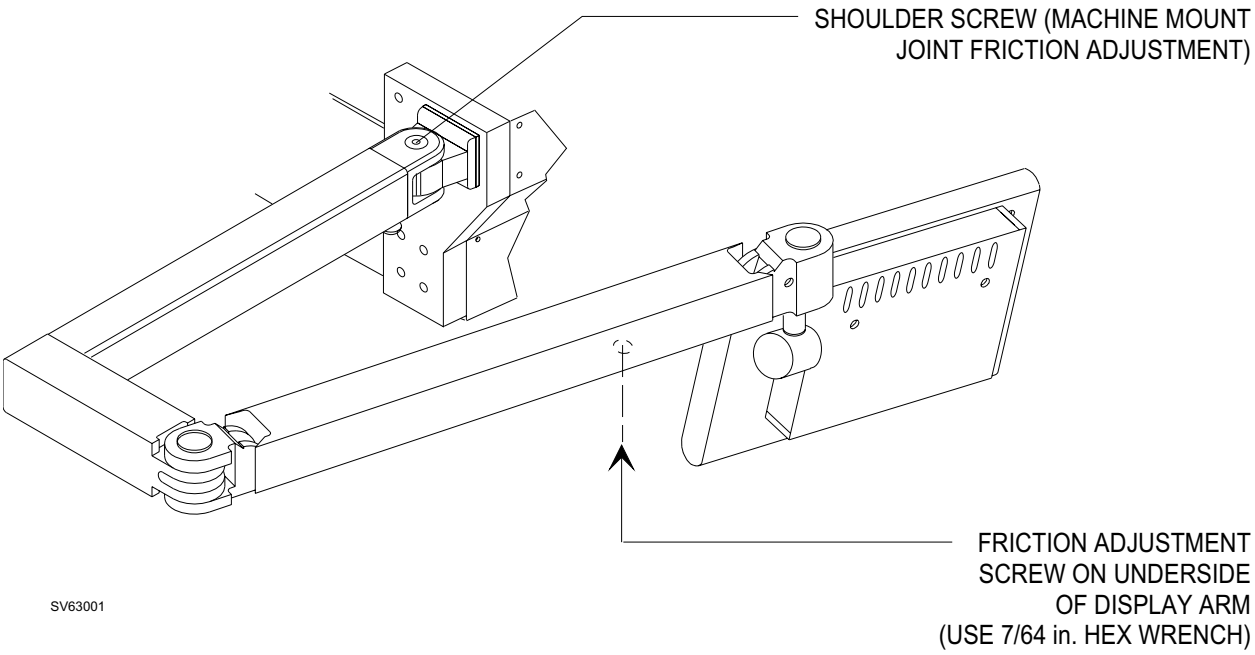


Figure 5-4: DISPLAY ARM ADJUSTMENTS

5.5 Oxygen Sensor Calibration

5.5.1 Turn the System Power switch to ON.

5.5.2 Enter the Main Service Screen (ref. Section 2), select the appropriate Service Code (PMS or SRVC) and enter your Technical Service Representative I.D. number.

5.5.3 Select MONITORS to bring up the Oxygen Monitor Service Screen.

5.5.4 Zero Calibration

5.5.4.1 Remove the oxygen sensor capsule from its housing and allow several minutes for the displayed offset readings to stabilize.

NOTE: The difference between the displayed CELL A and CELL B readings should be no greater than 8.

5.5.4.2 With the cursor set to STORE ZERO, press the trigger to store the current values as the new zero calibration.

5.5.4.3 Reinstall the sensor capsule in its housing.

5.5.5 21% Calibration

5.5.5.1 Expose the sensor to ambient air only (away from any open part of the breathing system) and allow it to stabilize for several minutes.

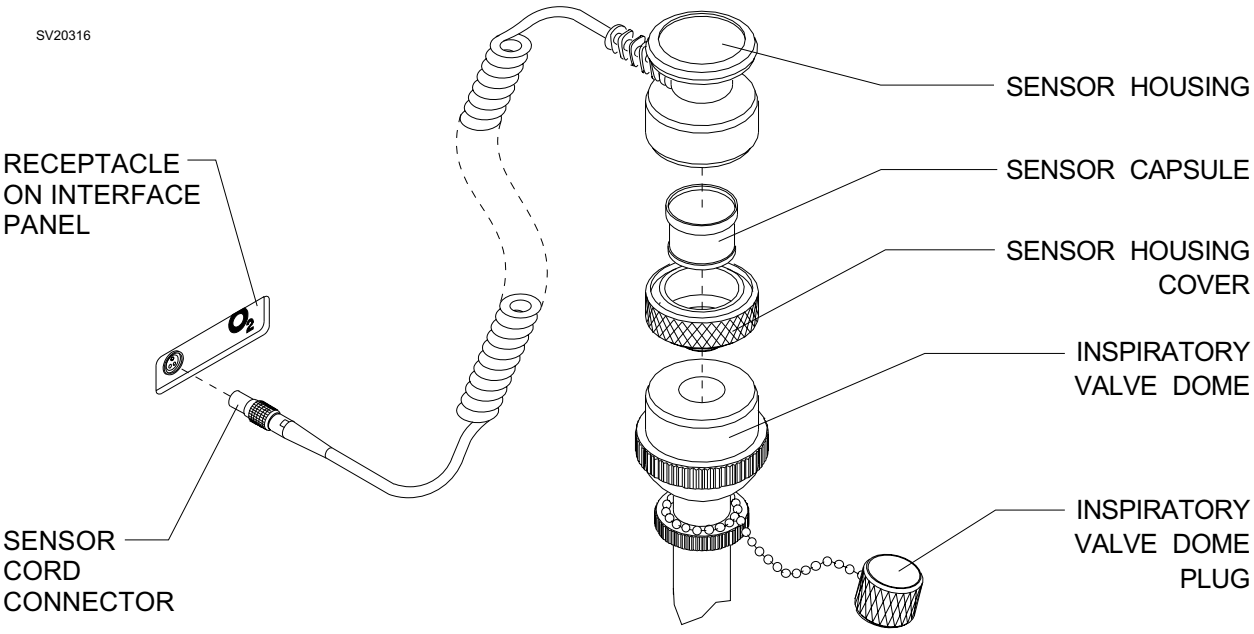
5.5.5.2 Set the cursor to EXIT and press the trigger to return to the Main Service Screen. Select EXIT again and press the trigger to return the display to normal operation.

5.5.5.3 Press the Datagrip trigger to display the Screen Selection Menu. Select the SET UP option and press the trigger.

5.5.5.4 Set the cursor to OXYGEN SENSOR, and press the trigger to initiate calibration. Follow the on-screen instructions.

5.5.5.5 When calibration is complete, reinstall the sensor assembly in the inspiratory valve dome.

NOTE: If the O_2 sensor will not calibrate properly, refer to the Oxygen Monitoring section of the NARKOMED 2C *OPERATOR'S INSTRUCTION MANUAL* for further information.



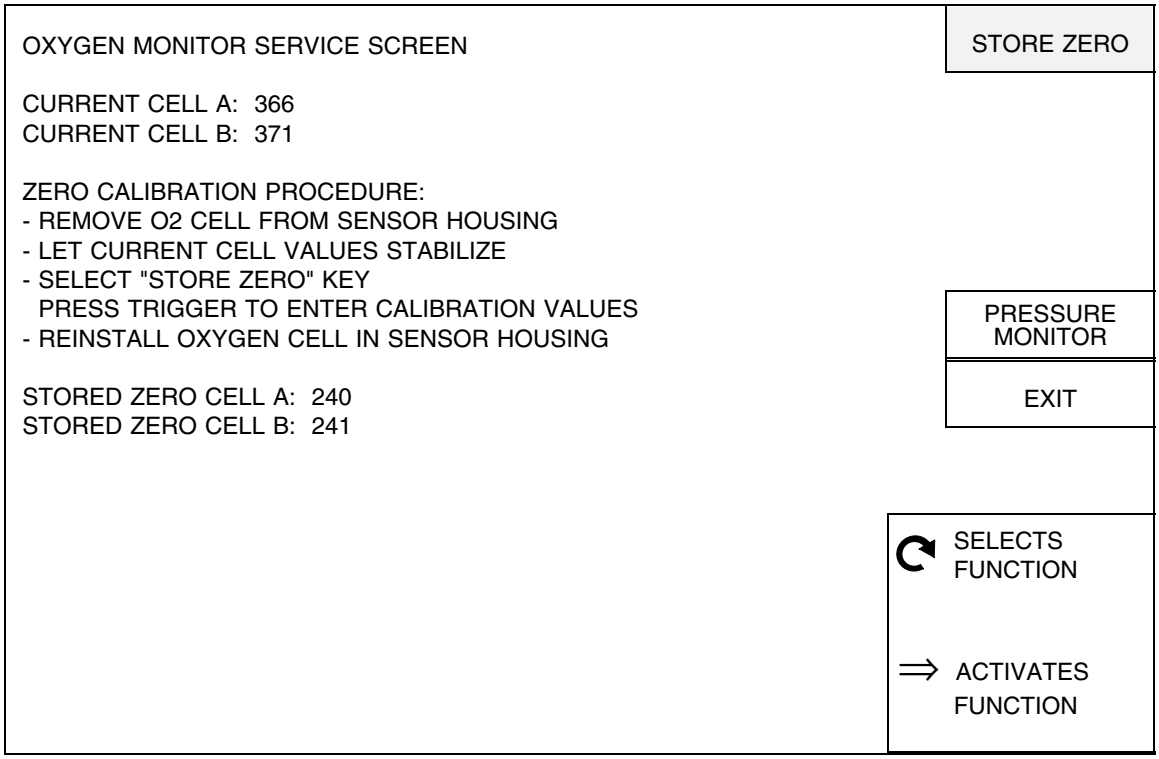

OXYGEN MONITOR SERVICE SCREEN
STORE ZERO
CURRENT CELL A: 366
CURRENT CELL B: 371
ZERO CALIBRATION PROCEDURE:
- REMOVE O2 CELL FROM SENSOR HOUSING
- LET CURRENT CELL VALUES STABILIZE
- SELECT "STORE ZERO" KEY
PRESS TRIGGER TO ENTER CALIBRATION VALUES
- REINSTALL OXYGEN CELL IN SENSOR HOUSING
PRESSURE MONITOR
STORED ZERO CELL A: 240
STORED ZERO CELL B: 241
EXIT
SELECTS FUNCTION
ACTIVATES FUNCTION

Figure 5-5: OXYGEN MONITOR SERVICE SCREEN

5.6 Breathing Pressure Monitor Calibration

5.6.1 Turn the System Power switch to ON.

5.6.2 Enter the Main Service Screen (ref. Section 2), select the appropriate Service Code (PMS or SRVC) and enter your Technical Service Representative I.D. number.

5.6.3 Select MONITORS and press the trigger. Place the cursor at PRESSURE MONITOR and press the trigger.

5.6.4 Zero Calibration

5.6.4.1 Disconnect the pressure sample line from the absorber and let the current pressure value stabilize.

5.6.4.2 Set the cursor to STORE ZERO and press the trigger to store the current value as the new zero.

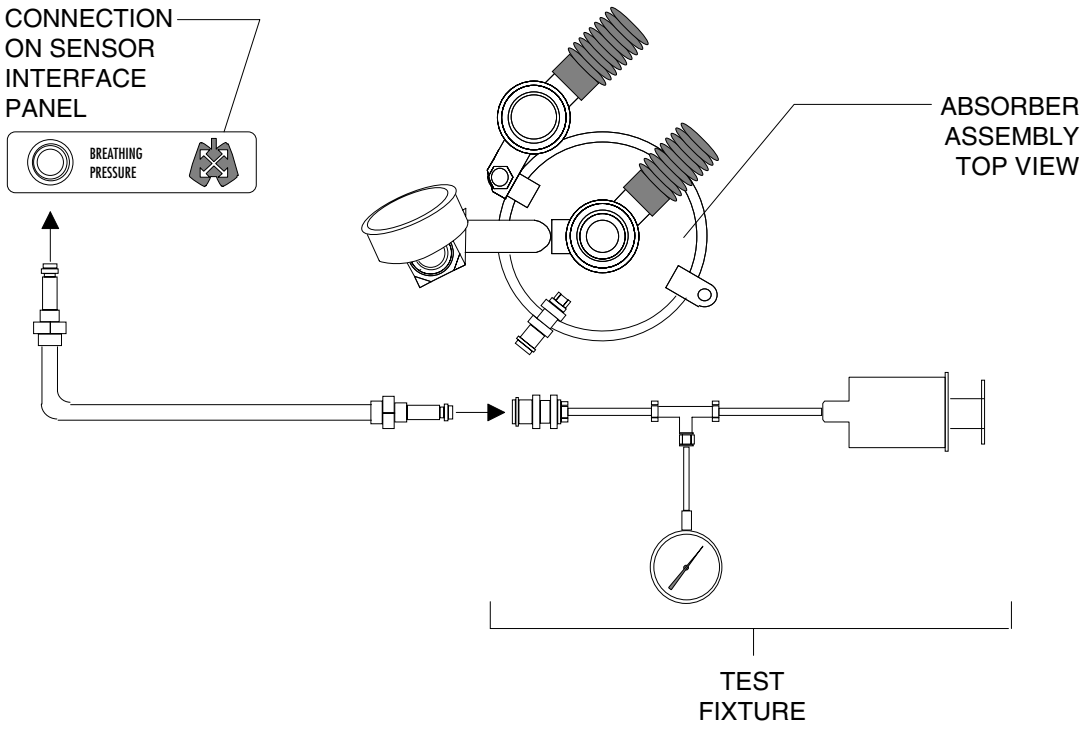
5.6.5 Span Calibration

5.6.5.1 With a test fixture connected as shown in Figure 5-6, apply a pressure of 50 cm H_2O to the pressure sample line.

5.6.5.2 When the displayed current value is stabilized, set the cursor to STORE SPAN and press the trigger to store the current value as the new span calibration.

5.6.6 Disconnect the test fixture.

5.6.7 Set the cursor to EXIT and press the trigger to return to the Main Service Screen.



PRESSURE MONITOR SERVICE SCREEN

CURRENT PRESSURE VALUE: 201

ZERO CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, EXPOSE TO AIR
- LET CURRENT PRESSURE VALUE STABILIZE
- SELECT THE "STORE ZERO" KEY AND PRESS THE TRIGGER TO ENTER THE CURRENT VALUE AS THE CALIBRATION ZERO VALUE.

SPAN CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER,
- APPLY 50 CMH20 CONSTANT PRESSURE AT THE SAMPLE LINE, VERIFIED BY A KNOWN, CALIBRATED METER
- LET CURRENT VALUE STABILIZE
- SELECT THE "STORE SPAN" KEY AND PRESS THE TRIGGER TO ENTER THE CURRENT VALUE AS THE CALIBRATION SPAN VALUE.

STORED ZERO: 205
STORED SPAN: 544

STORE ZERO
STORE SPAN
OXYGEN MONITOR
EXIT

↻ SELECTS FUNCTION

⇒ ACTIVATES FUNCTION

Figure 5-6: PRESSURE MONITOR SERVICE SCREEN

5.7 Vaporizer Interlock Adjustment

5.7.1 Set the System Power switch to STANDBY.

5.7.2 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position. If the left or right vaporizer does not lock, tighten the corresponding center set screw until the handwheel locks properly.

5.7.3 Turn the center vaporizer OFF and turn the left vaporizer ON. The center and the right vaporizer handwheels should be locked in their Zero position. If the right vaporizer does not lock, loosen the locking nut on the right set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: Do not over-tighten the set screws. Each vaporizer handwheel must turn easily while the other vaporizers are locked .

5.7.4 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position. If the left vaporizer does not lock, loosen the locking nut on the left set screw and adjust the set screw until the handwheel locks properly. Tighten the locking nut while holding the set screw to maintain the correct adjustment.

NOTE: When the interlock adjustment procedure is completed, ensure that all vaporizer handwheels are set to their zero or OFF position.

5.7.5 Perform the PMS Procedure given in Section 6.

VAPORIZER INTERLOCK MECHANISM REAR VIEW

SV40660

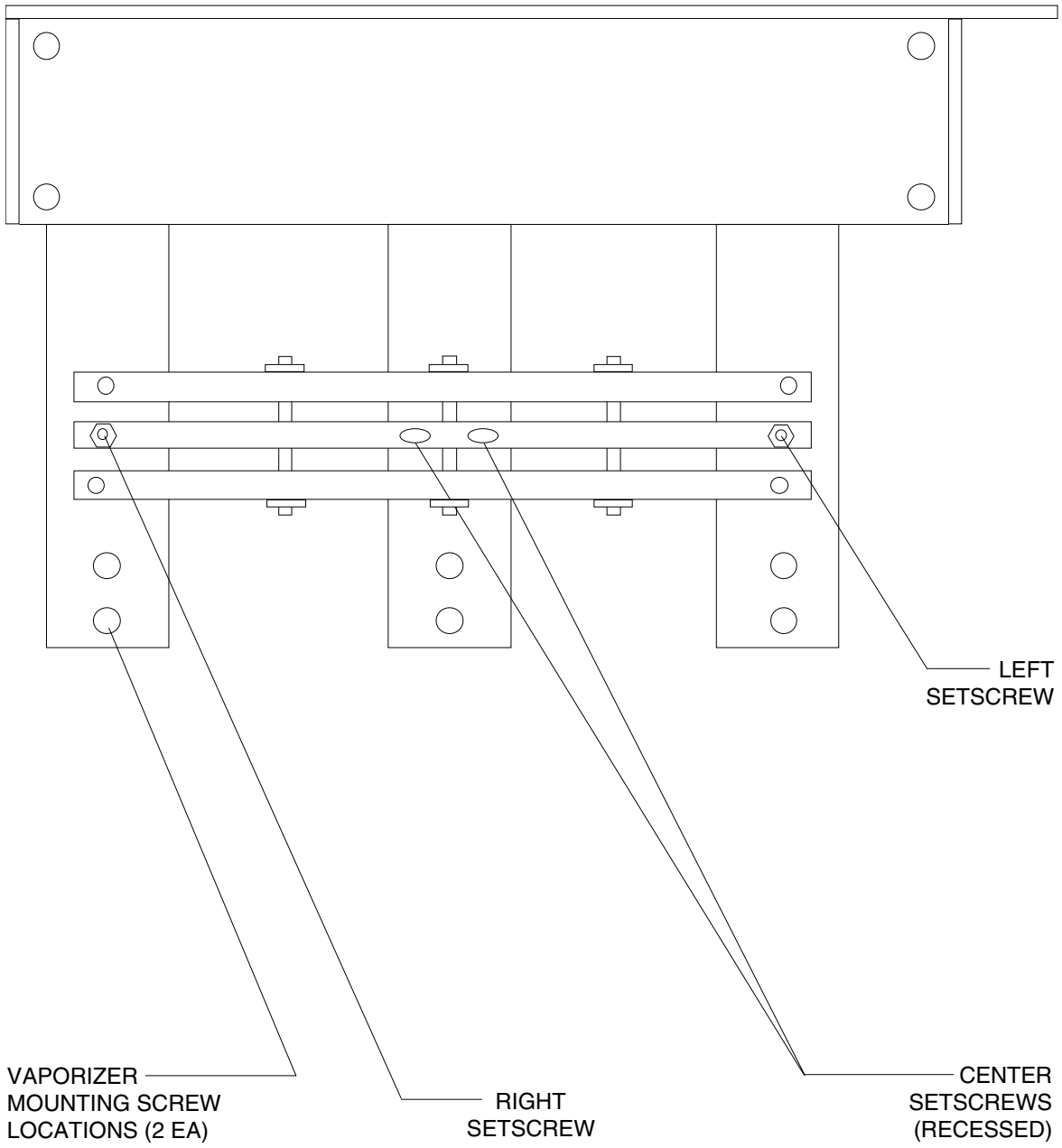


Figure 5-7: VAPORIZER INTERLOCK ADJUSTMENT

6.0 PMC PROCEDURE, NARKOMED 2C

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Certification (PMC) visits. A PMC Checklist form, P/N S010211, available from the Draeger Medical, Inc. Technical Service Department, shall be completed by the TSR each time a PMC is performed. Steps in the procedure marked with (✓) require a response at the corresponding line on the checklist form.

Space is also provided on the PMC checklist form to record the results of a vapor concentration test.

NOTE: Test equipment listed below with an asterisk (*) requires calibration at a maximum interval of one year. Verify the dates on test equipment calibraitonlabels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration.

In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used. Also record the calibration due dates.

Test Equipment Required:

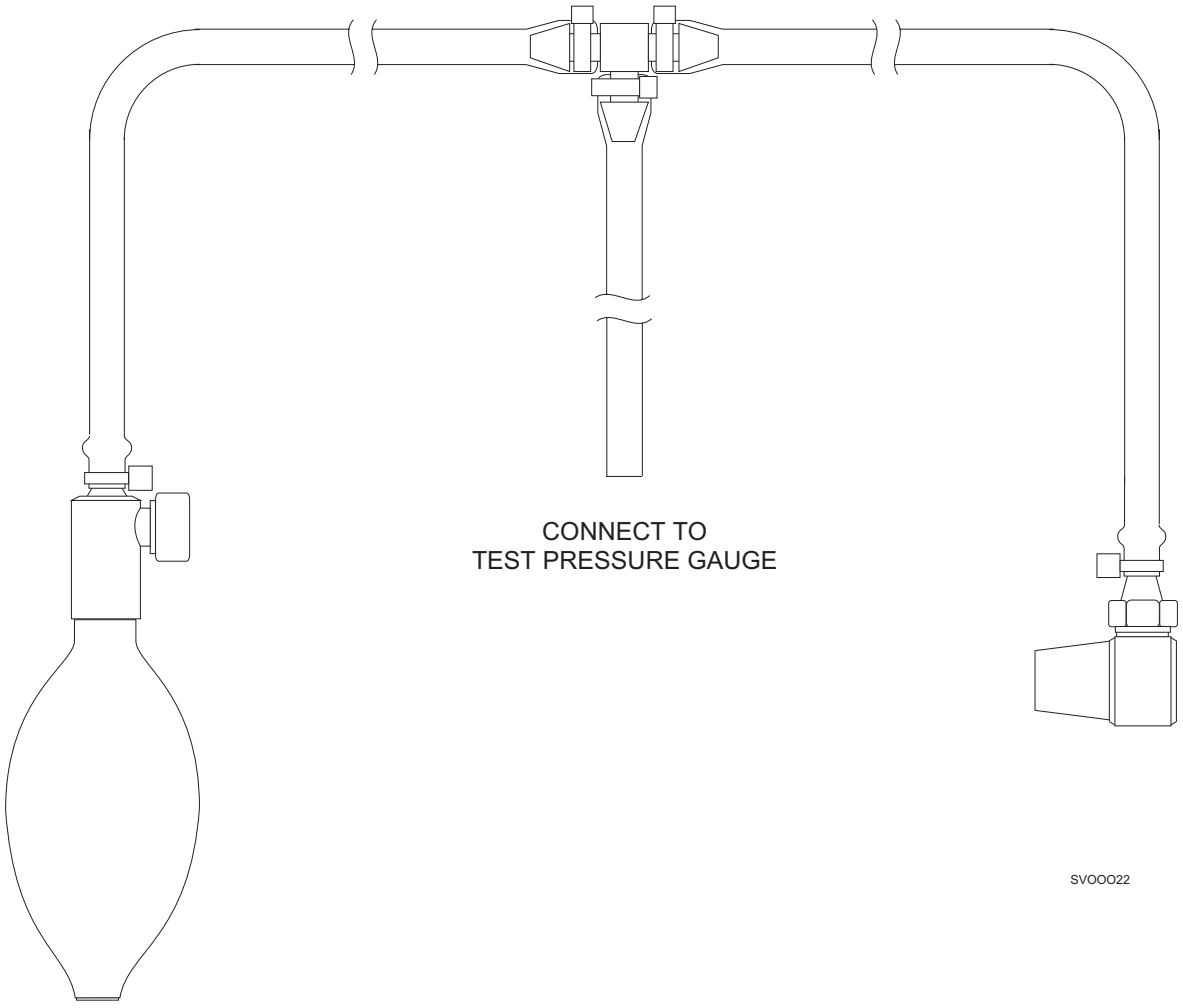
*-- Multi-Meter (Fluke or equivalent)
*-- Electrical Safety Analyzer (Biotek 501 Pro or equivalent)
*-- Regulator Test Pressure Gauge, P/N S000063 or equivalent
-- Fresh Gas Outlet Volume Test Device, P/N S010158 or equivalent
-- Fresh Gas Leak Test Device, P/N 4113119 or equivalent
-- Adapter Assembly, Test Terminal, P/N 4104389 or equivalent: two are required
*-- Flowmeter Test Stand (Capnomed), P/N S000081 or equivalent
-- Breathing System Leak Test Device, P/N S010159 or equivalent
-- Baromed Pressure Test Fixture or equivalent
*-- Test Minute Volume Meter, P/N 2212300 or equivalent
*-- Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)
*-- Riken Gas Indicator, Model 18H, or 1802D or equivalent
-- Stop Watch
-- Service Test Lung, P/N 4115128

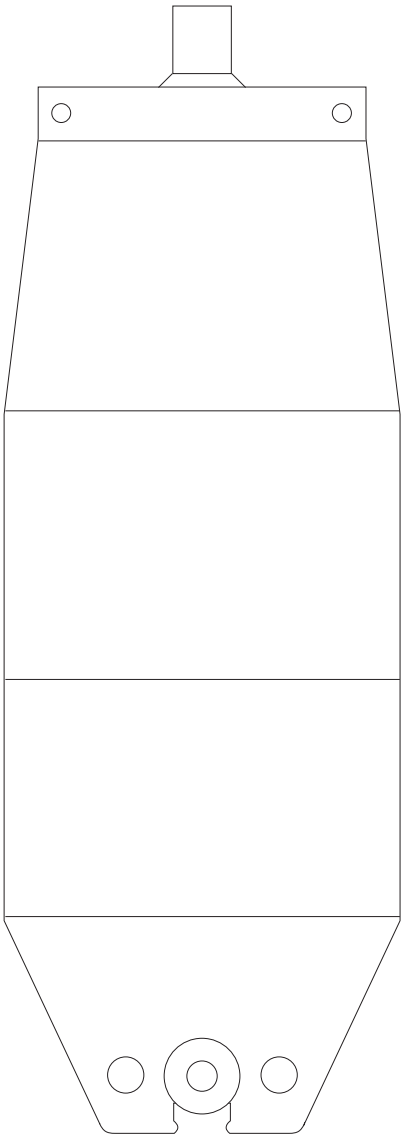
Materials Required:

-- Dow Corning High Vacuum Grease, P/N S4105908
-- Spiromed Sensor Lubrication Kit, P/N 2218180
-- Breathing Bag, 3 liter, P/N 9995330 or equivalent
-- Tube, Corrugated, 22 mm x 12 in. long, P/N 9995112

Test equipment illustrations are shown on following pages.

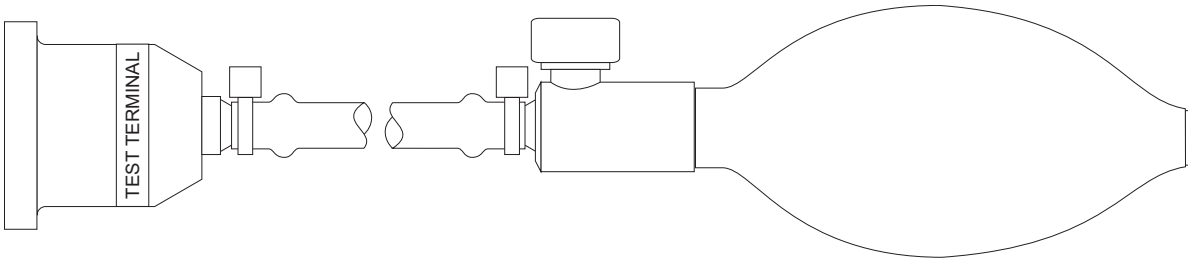
4113119
FRESH GAS LEAK TEST DEVICE



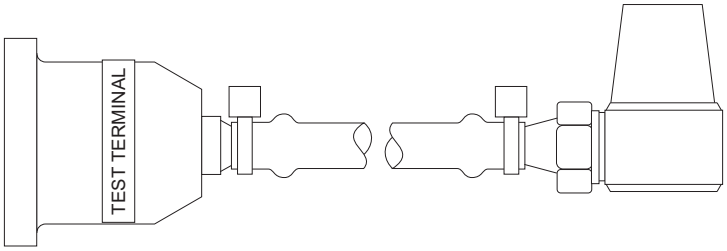


4115128
SIEMENS TEST LUNG

SVOOO25



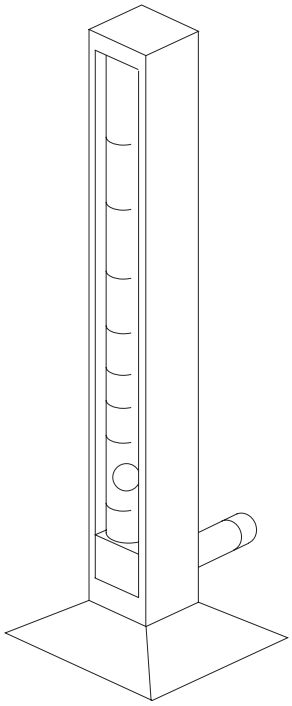
S010159
BREATHING SYSTEM LEAK TEST DEVICE



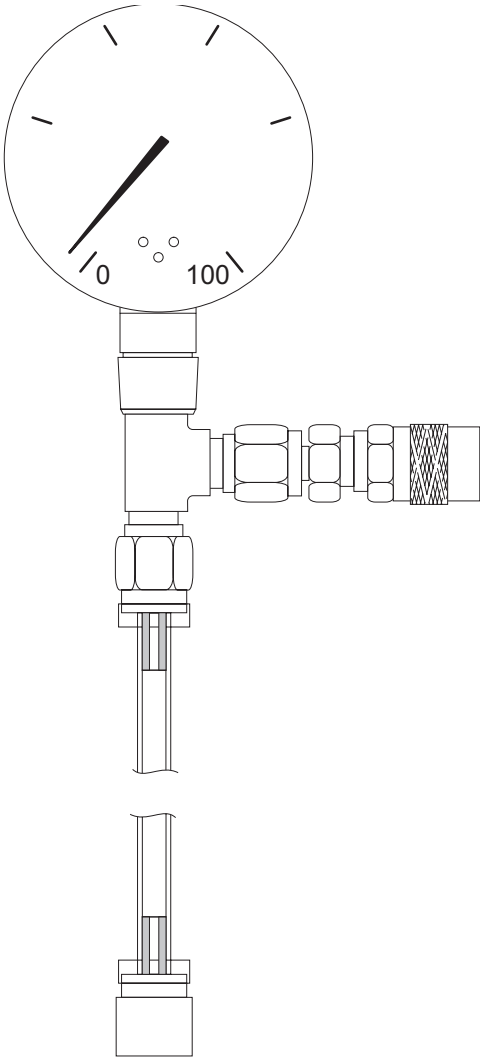
SVOOO23

S010158
FRESH GAS OUTLET VOLUME TEST DEVICE

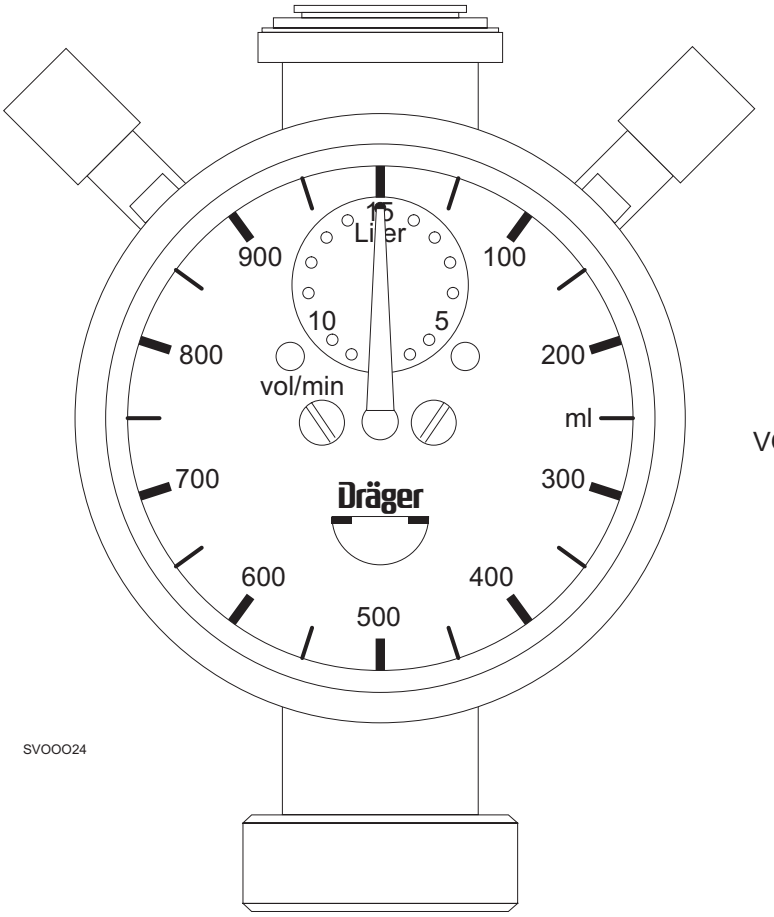
SVOOO27



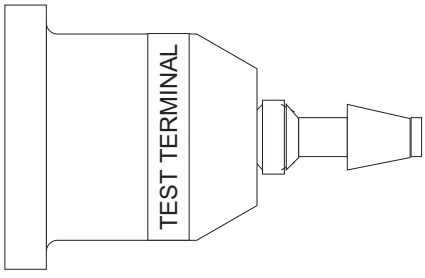
S000081
FLOW METER
TEST STAND



S000063
REGULATOR TEST
PRESSURE GAUGE



2212300
MINUTE
VOLUMETER



4104389
TEST TERMINAL
ADAPTER

Periodic Manufacturer's Certification General Instructions

The purpose of these procedures is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on the Narkomed 2C anesthesia machine.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a certification level inspection based on Draeger Medical, Inc. Recommendations and equipment performance. Additional inspections are also performed to insure proper product labeling.

Several additional documents have been created to ensure the success of this new program. Following is a brief description of the purpose of each document.

Field Service Procedure:
Periodic Manufacturer's Certification Forms - Part Number SP00175.
This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from Draeger Medical, Inc.'s *Anesthesia System Risk Analysis and Risk Reduction* is included, and also a sample of an Executive Summary to be furnished to the hospital's Risk Manager or Chief of Anesthesia.

Field Service Procedure:
DMI Recommendations Guidelines Index Anesthesia Systems - Part Number S010250.
This Guideline was created to provide an assessment of each machine's certification. It contains various comprehensive overviews of possible equipment conditions and their associated certification levels.

The first list in the Recommendation Guidelines is a reference chart for machine certification based on equipment status. The second is an abbreviated summary of all DMI Recommendations and Failure Codes including the Condition Number, Equipment Condition, Recommended Corrections, Certification Code, and Tests Affected when applicable.

There is also a matrix classified as "Failure Codes" which identifies the correct manner in which to document equipment tests that fail, or were unable to be performed due to circumstances beyond the control of the service technician performing the inspection. (Ex: Air cylinder supply is unavailable to perform Air High Pressure Leak test.) The Failure Codes section also indicates suggested resolution of the situation. Failure Code numbers begin at 34 and use the same certification levels strategy, and carry the same weight as DMI Recommendation equipment condition codes.

The final matrix is the most comprehensive index sorted by machine model and includes Equipment Condition, Certification Code, and DMI Recommendations. It also specifies any suggested upgrade path including ordering information that should be taken such as installing a Bellows with Pressure Limit Control 4109664-S01 Kit, after market modification kit to a machine not equipped with pressure limit control.

The letters A, B, C, D and the Roman Numerals I, II are used as codes in the individual matrix for each model of anesthesia machine. The letters A, B, C, and D are used in descending order to indicate the certification level of the equipment. They are as follows:

A = Certified
B = Certified with Recommendations
C = Conditionally Certified
D = No Certification

Roman Numerals I and II do not affect the certification level but rather are provided to give further instructions to the end user as follows:

I = The system in its present configuration shall only be used with a CO2 monitor incorporating an apnea warning. The operator of the system is advised to frequently scan the CO2 readings and alarm thresholds.

II = The present configuration of equipment requires that the unit operate at all times with an oxygen analyzer that includes a low oxygen warning. The operator of the system is advised to frequently scan the oxygen readings and alarm limits.

Following is an explanation of machine certification levels:

Certified- No recommendations apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered recommendation with a code of B applies to the machine being examined.

Conditionally Certified- A numbered recommendation with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered recommendation with a code of D applies to the machine being examined.

When multiple recommendations apply, "No Certification" would take precedence over "Conditionally Certified" and "Certified with Recommendations". "Conditionally Certified" would take precedence over "Certified with Recommendations".

For example:

A **Narkomed 3** could have recommendation number 21 and failure code 61.1 apply.
21 - No ventilator pressure limit control. Code is B.
61.1 - Enflurane agent is unavailable to test. Code is BC.
Correct certification for this machine is BC, which means CONDITIONALLY CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed** 4 could have recommendation numbers 14 and 21 apply.
14 - CO2/Agent monitor exhaust port is not properly connected to the waste gas scavenger. Code B.
21 - No ventilator pressure limit control. Code B.
The correct certification for this machine is B, which means CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed 2B, 2**C or **GS** could have recommendation 30 apply.
30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.
The correct certification for this machine is B, which means CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed 6000** could have no DMI recommendations or failure codes apply. The correct certificaiton level for this machine is Code A, CERTIFIED.

Code D, which means NO CERTIFICATION, also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall also receive a 'WARNING - This System is Not Certified' label, P/N 4114857. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and 'Vigilance Audit® Validation' labels have been removed.

PM Certification Procedure for Narkomed 2C Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS Anesthesia Systems (P/N S010211).

2. Completely fill in the header information.

3. All Narkomed 2Cs are equipped with Humphrey valves. Indicate so with a (H) next to the "MJV-2 LUBRICATION" line on the Periodic Manufacturer's Certification form.

4. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM in accordance with SP00075. Place a check mark and the replacement date at "VENT RELIEF VALVE REPLACEMENT" line on the Periodic Manufacturer's Certification form.

5. If a TEC 6 DESFLURANE vaporizer is mounted to the machine, a label stating: "WARNING THE ADMINISTRATION OF DESFLURANE ANESTHESIA MAY REQUIRE FRESH GAS CONCENTRATIONS HIGHER THAN COMMONLY USED WITH OTHER VOLATILE ANESTHETIC AGENTS. O2 FRESH GAS CONCENTRATION OF LESS THAN 21% MAY BE OBTAINED WITH HIGH VAPORIZER SETTINGS. CONTINUOUS MONITORING OF THE O2 CONCENTRATION IN THE BREATHING SYSTEM IS THEREFORE REQUIRED. DRAEGER MEDICAL, INC. RECOMMENDS THE CONTINUOUS MONITORING OF THE CONCENTRATION OF ANESTHETIC VAPORS IN THE BREATHING SYSTEM DURING THE ADMINISTRATION OF INHALATION ANESTHESIA."(part # 4112737-001) Shall be attached to the vapor box immediately above the TEC 6 vaporizer.

6. Check all vapor 19 and 19.1 vaporizers for correct labeling. All vaporizers must have a label stating "THE CONCENTRATION OUTPUT OF THIS VAPORIZER SHALL BE VERIFIED AFTER IT HAS BEEN ATTACHED TO THE ANESTHESIA MACHINE" (part # S010015). This label shall be attached to the rear of the vaporizer directly below the mount.

7. All Key Index Safety Systems vaporizers, (K.I.S.S.) must have a label stating "CAUTION: AFTER FILLING HAS BEEN COMPLETED, REINSERT PLUG INTO UPPER FILLER PORT AND TIGHTEN LOCKING SCREW" (part # 4112520-001). This label shall be attached to the vaporizer directly above the keyed filler. Place a check mark at "K.I.S.S. LABEL" on the PM Certification form.

8. If machine is equipped with a HALOTHANE Dräger Vapor 19 or 19.1 vaporizer, determine if vaporizer must be inspected for soil condition one. Check the serial number plate located on the rear of the vaporizer for a plus (+) preceding the serial number. A HALOTHANE vaporizer serial number not preceded with a (+) must be tested for soil in accordance with SP00073. If vaporizer does not need to be inspected, indicate so with a plus (+) next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil condition 0, indicate so with "SOIL 0" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. If vaporizer is soil one, indicate so with "SOIL 1" written next to the "Vapor Inspection (H)" line on the Vigilance Audit form. Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and apply a replacement vaporizer or an adapter block onto the mount. All "SOIL 1" vaporizers must be removed from service for machine to receive certification.

PM Certification Procedure for Narkomed 2C Anesthesia System

9. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073 at a six month maximum interval. Perform the vaporizer concentration test on all Desflurane vaporizers in accordance with SP00091 for fixed mount vaporizers and SP00189 for user removable D-tec vaporizers at a six month maximum interval. For every vaporizer tested, fill out a "VAPOR VAPORIZER CALIBRATION CHECK" label (part # S010016). Information on this label shall include your signature, type of agent, date tested, test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check "NO" in the "RECOMMENDED FOR USE" section on the PM Certification form.

   Place a "CAUTION DO NOT USE" label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional Dräger vapor vaporizers must be removed from service for machine to receive certification.

10. Proceed with PM Certification procedure. If any tests fail refer to the "Failure Codes" listing in NAD Recommendations Guidelines Index (P/N S010250) to determine correct certification level starting point. Failure codes shall be documented on the "RECOMMENDATIONS / GENERAL COMMENTS" section of the PM Certification form and on the Executive Summary. If a test fails that has not been identified by the "Failure Codes" list, consult with Draeger Medical, Inc. to assess the proper certification level.

11. Based on the "EQUIPMENT CONDITION" inspect the machine for any "DMI RECOMMENDATIONS" that would apply. Use the Narkomed 2C section of the "RECOMMENDATION GUIDELINES INDEX" (P/N S010250). Note all applicable DMI recommendations on the Executive Summary. NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the "RECOMMENDATIONS / GENERAL COMMENTS" section of the form.

12. Determine the correct certification level of the machine based on the combined lowest common denominator of "Equipment Conditions" and "Failure Codes". If the machine is at least conditionally certified fill out the "PM CERTIFICATION" label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to "NEXT VISIT DUE:" If certification level is "D", machine shall not receive a "PM CERTIFICATION" label. Any machine not receiving a PM Certification label shall receive a "WARNING NOT CERTIFIED" label. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.

13. In the "CERTIFICATION LEVEL" section of the PM Certification form, record the last visit certification level, the current certification level and the next visit due month and year, (three months from date of PM Certification) in the spaces provided.

14. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or P/N S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.

15. Check the appropriate boxes on the "PM CERTIFICATION NOTICE" label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice to the flow shield of the anesthesia machine.

16. Have the customer sign each PM Certification form or the Executive Summary, and review the equipment conditions and the recommendations with the customer.

17. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

6.1 ELECTRICAL SAFETY

(✓) 6.1.1 Ground Continuity

6.1.1.1 Turn the System Power switch to STANDBY.

NOTE: Do not plug the safety analyzer power cord into a line isolation monitor, as inaccurate readings may occur.

Plug the unit into the safety analyzer, and plug the power cord of the safety analyzer into an AC receptacle.

NOTE: The BIOTECH 501 PRO will automatically test the source outlet for open ground (or ground resistance of 31 Ω or higher), reverse polarity, open neutral and open line. (The latter two conditions will prevent the analyzer from powering up.)

6.1.1.2 Set the safety analyzer function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the SINGLE LEAD connector of the analyzer. Connect the other end of the red test lead to the ground socket of the front panel outlet on the safety analyzer. Verify a displayed resistance of 0.000 Ω or, if necessary, press the CALIBRATE key on the front panel of the analyzer to zero the device.

6.1.1.3 Set the safety analyzer GROUND switch to NORMAL. Set the POLARITY switch to OFF.

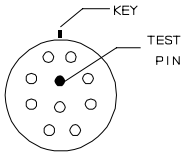
6.1.1.4 The safety analyzer shall indicate 0.1 Ω or less with its test lead applied to the following points:

--Cylinder yoke
--Power supply assembly chassis
--Each convenience outlet ground socket
--Each Auxiliary Outlet Strip ground socket

(✓) 6.1.2 Circuit Isolation

6.1.2.1 Disconnect the respiratory volume sensor cord from the interface panel.

6.1.2.2 With a multimeter set to its highest resistance range, check for continuity between the power supply chassis and the circuit common at the sensor interface connector keyway pin (use the 12 o'clock position for the Spiromed connector or the position indicated in the illustration for the ultrasonic flow sensor connector). There shall be no continuity between these points.



(✓) 6.1.3 Convenience Outlet and Auxiliary Outlet Strip

NOTE: This test will check the convenience outlets and the auxiliary strip outlets for fault conditions such as open ground (>31 Ω), reverse polarity, open line and open neutral. This is done each time the BIOTECH 501 PRO is powered up and allowed to cycle through its self test.

6.1.3.1 Shut off and unplug the safety analyzer. Remove the anesthesia machine plug from the analyzer, and plug it into the same outlet that was being used by the analyzer.

6.1.3.2 Plug the safety analyzer into the first convenience outlet to be tested, and turn the analyzer power switch ON. Allow the analyzer to cycle through its Auto Test sequence. If no wiring fault is indicated, shut off the analyzer and move its plug to the next convenience outlet. Test this outlet in the same manner, and continue until all convenience outlets and auxiliary strip outlets are tested.

6.1.4 Chassis Leakage Current

6.1.4.1 Turn the anesthesia machine System Power switch to ON and set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.

6.1.4.2 Attach the safety analyzer test lead to a cylinder yoke.

(✓) 6.1.4.3 Record the total leakage current with the Polarity and Ground switches set as follows:

Ground	Polarity
Open	Normal
Normal	Normal
Open	Reversed
Normal	Reversed

Verify that the leakage current is 75* microamps or less in each of the switch positions (110 microamps or less for the 220/240 volt power supply option).

* 100 microamps if external monitors are plugged into convenience outlets.

(✓) 6.2 SELF-DIAGNOSTICS

6.2.1 Connect the pipeline supply or open the cylinders.

6.2.2 Turn the System Power switch to ON.

6.2.3 Verify that the following is displayed on the alarm CRT:

VIDEO	PASS	NARKOMED 2C
FIRMWARE	PASS	COPYRIGHT 1993, NAD, INC.
STATIC RAM	PASS	VERSION X.XX NM2C SW
TIMER	PASS	SOFTWARE ID. XXXX
A/D CONVERTER	PASS	
AUDIO - PRIMARY	PASS	
- BACKUP	PASS	
SERIAL I/O	PASS	
CLOCK	PASS	
NON-VOLATILE MEMORY	PASS	

FUNCTIONAL

(✓) 6.2.4 Record the machine software version on the header of the checklist form.

(✓) 6.3 BATTERY CIRCUIT

6.3.1 Is "ON" LED lighted? __ (Y)

6.3.2 With the System Power switch ON, unplug the AC power cord.

6.3.3 Is yellow "AC PWR FAIL" LED lighted as long as the power cord is unplugged? __ (Y)

6.3.4 Does the "AC PWR FAIL" message appear in the Advisory display? __ (Y)

6.3.5 Press and hold the "BATTERY TEST" button.

6.3.6 Is green Battery Test LED lighted as long as "BATTERY TEST" button is depressed? __ (Y)

6.3.7 Release the "BATTERY TEST" button.

6.3.8 Restore AC power to the machine.

6.3.9 Does the "AC PWR FAIL" message disappear and the LED extinguish?

(✓) 6.4 CONFIGURATION

6.4.1 Press the Datagrip trigger, select SET and enter the SYSTEM CONFIGURE screen.

6.4.2 The remote display shall display the Configuration Screen.

6.4.3 Verify the correct Time and Date.

6.4.4 Adjust the Volume to the highest setting.

6.5 SERVICE DATA

6.5.1 On the display key panel, press and hold the Speaker Disable and LOG DATA or VENT ALARMS OFF keys (simultaneously), and then press the Datagrip trigger (while still holding the keys).

6.5.2 The remote display shall display the Main Service Screen.

(✓) 6.5.3 Record the Last Service Date on the PMS form.

(✓) 6.5.4 Record the Hours Run Since Last Service on the PMS form.

(✓) 6.5.5 Record the Total Hours Run on the PMS form.

6.5.6 Select and enter the Service Log.

6.5.7 Verify any pertinent information from the Service Log. Contact the Draeger Medical, Inc. Technical Service Department if necessary.

6.5.8 Set the cursor to EXIT and press the trigger to return to the Main Service Screen.

6.5.9 Select the PMS Service Code and press the Datagrip trigger.

6.5.10 Select and enter your Technical Service Rep. I.D. number.

(✓) 6.5.11 Set the cursor to RESET and press the trigger. This resets the last service date to the current date and resets the hours run since last service to zero.

6.5.12 Set the cursor to PMS CRITERIA and press the trigger.

(✓) 6.5.13 Select and enter the month of the next service due date. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

6.6 CALIBRATIONS

6.6.1 Set the cursor to MONITORS and press the trigger to bring up the Oxygen Monitor Service Screen.

6.6.2 Remove the oxygen sensor from the valve dome adapter, and remove the oxygen sensor capsule from the oxygen sensor housing.

(✓) 6.6.3 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, set the cursor to STORE ZERO and press the trigger to store the values.

NOTE: The higher the offset, the higher the calculated oxygen concentration appears at high concentrations.

6.6.4 Put the oxygen sensor capsule into the oxygen sensor housing.

6.6.5 Set the cursor to PRESSURE MONITOR and press the trigger to enter the pressure monitor service screen.

6.6.6 Disconnect the Baromed breathing pressure sensor line from the absorber and expose it to air.

6.6.7 Let the Current Pressure Value stabilize, set the cursor to STORE ZERO and press the trigger.

6.6.8 Connect a test fixture and calibrated digital pressure manometer to the breathing pressure sensor line.

6.6.9 Pressurize the circuit to 50 cm H_2O and allow the Current Value to stabilize.

(✓) 6.6.10 Set the cursor to STORE SPAN; press the trigger and verify that new span values are stored.

6.6.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.

6.6.12 Set the cursor to EXIT and press the trigger to return to the Main Service screen.

6.6.13 Set the cursor to EXIT and press the trigger to return to normal operation.

(✓) 6.7A SCAVENGER, A/C - if applicable

6.7A.1 Scavenger, A/C Cleaning

6.7A.1.1 Remove all scavenger hoses one at a time, and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.7A.1.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.

6.7A.1.3 Inspect the rubber O-ring and replace if worn.

6.7A.1.4 Remove the safety relief valve from its housing by twisting it out in a counter-clockwise direction. The tips of needle-nose pliers can be used to turn the valve. Be careful not to damage the valve disk.

6.7A.1.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen. The scavenger body can be cleaned with a moist cloth.

6.7A.1.6 Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.

6.7A.1.7 Make sure that the interior of the valve body is completely dry. Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.7A.2 Scavenger, A/C Positive Pressure Relief

6.7A.2.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a short 19 mm scavenger hose between the APL valve and the port on the rear of the absorber pole. Connect a 19 mm scavenger hose between the ventilator relief valve and the left-hand port on the scavenger.

6.7A.2.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.7A.2.3 Set the Man/Auto valve to the AUTO position.

6.7A.2.4 If the absorber system or ventilator bellows are equipped with a PEEP valve, turn the PEEP valve control knob fully counter-clockwise.

6.7A.2.5 Set the oxygen flow to 10 l/min. and occlude the 19 mm scavenger terminal labeled EXHAUST.

6.7A.2.6 After the ventilator bellows inflates, the flow of oxygen will exit the system through the positive pressure safety relief valve. At this point, the absorber system breathing pressure gauge shall indicate a pressure of 10.0 cm H_2O or less.

(✓) 6.7B SCAVENGER, OPEN RESERVOIR - if applicable

6.7B.1 Scavenger, Open Reservoir Cleaning

6.7B.1.1 Remove all scavenger hoses one at a time and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.7B.1.2 Disconnect the hospital vacuum source from the scavenger.

6.7B.1.3 If applicable, remove the scavenger flow control needle valve assembly. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air if necessary, and reinstall the needle valve assembly.

6.7B.1.4 Remove the scavenger mounting screws.

6.7B.1.5 Remove the two screws securing the access panel at the bottom of the scavenger canister.

6.7B.1.6 Remove and inspect the silencer; replace if needed.

6.7B.1.7 Remove the reservoir canister from the scavenger body by unscrewing the four socket head cap screws located at the top of the canister.

6.7B.1.8 Remove the flowmeter from its housing by turning it counter-clockwise. Inspect the tube and clean with compressed air if needed.

6.7B.1.9 Reassemble the scavenger assembly, and reactivate the vacuum source.

6.7B.2 Scavenger, Open Reservoir Negative Pressure Relief

6.7B.2.1 Connect a 19 mm scavenger hose between the bottom of the absorber pole and the right-hand port on the scavenger. Connect a 19 mm scavenger hose between the APL valve and the rear port on the absorber pole. The left-hand scavenger port may be capped for this test, or may be connected to the ventilator relief valve. Connect a DISS vacuum hose to the threaded terminal on the left side of the scavenger. Alternatively, an adapter can be used to attach a wall suction hose to the hose barb fitting on the adapter.

6.7B.2.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber or the expiratory hose terminal on the ultrasonic flow sensor, if applicable. Set the Man/Auto selector valve to the BAG position. Turn the APL valve control knob fully counter-clockwise.

6.7B.2.3 Verify that the suction waste gas disposal system is active.

6.7B.2.4 Adjust the scavenger needle valve until the flowmeter indicates between the white lines. Close all flow control valves on the anesthesia machine. Occlude the absorber breathing bag terminal.

6.7B.2.5 Install a scavenger adapter with a hose barb (P/N 4108114) between the 19 mm hose terminal of the scavenger, and the scavenger hose. Connect a calibrated test pressure monitor to the hose barb on the adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of 0 to -0.5 cm H_2O.

6.7B.3 Scavenger, Open Reservoir Positive Pressure Relief

6.7B.3.1 Turn the scavenger needle valve fully clockwise (closed).

6.7B.3.2 Open the oxygen flow control valve on the anesthesia machine to a flow of 10 l/min. and occlude the absorber breathing bag terminal.

6.7B.3.3 The flow of oxygen shall now exit the system through the relief ports around the top of the canister. The test pressure gauge shall indicate a pressure less than 1.0 cm H_2O.

6.7B.3.4 After the test, adjust the scavenger needle valve for a flowmeter indication halfway between the two white lines.

(✓) 6.7C SCAVENGER INTERFACE - if applicable

6.7C.1 Scavenger Inspection

6.7C.1.1 Check all scavenger hoses and reservoir bag for deterioration. Replace all worn components.

6.7C.2 Primary Negative Relief Valve Cleaning:

6.7C.2.1 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.

6.7C.2.2 Remove the valve and washer from the scavenger body by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.7C.2.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.7C.2.4 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.

6.7C.3 Secondary Negative Relief Valve Cleaning:

6.7C.3.1 Unscrew the chrome plated valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

6.7C.3.2 Unscrew the valve from the housing by turning it in a counter-clockwise direction.

6.7C.3.3 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.7C.3.4 Reinstall the valve in the housing, and then reinstall the housing into the scavenger body. Note: This valve does not require washers or O-rings.

6.7C.4 Positive Relief Valve Cleaning:

6.7C.4.1 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.

6.7C.4.2 Inspect the rubber O-ring and replace if worn.

6.7C.4.3 Remove the valve from the housing by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.7C.4.4 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean air or oxygen.

6.7C.4.5 Reinstall the valve and plastic washer into the housing.

6.7C.4.6 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.7C.5 Negative Pressure:

6.7C.5.1 Connect a 22mm breathing hose between the absorber's inspiratory and expiratory valves. Set the Man/Auto valve to the BAG position. Turn the APL valve fully counter-clockwise. Occlude the bag mount connector.

6.7C.5.2 Verify that the suction waste gas disposal system is active.

6.7C.5.3 Close all flow control valves on the machine. Adjust the scavenger needle valve to allow typical suction through the scavenger.

6.7C.5.4 Install a scavenger adapter (P/N 4108114) with a hose barb between the 19mm hose terminal of the scavenger and the scavenger hose. Connect a test monitor to the hose barb adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <-1.0 cmH_2O.

6.7C.6 Positive Pressure:

6.7C.6.1 Close the scavenger needle valve by turning it fully clockwise.

6.7C.6.2 Push the O_2 Flush button to inflate the scavenger reservoir bag. Open the oxygen flow control valve to 10 l/min.

6.7C.6.3 Observe the pressure reading on the test gauge. The gauge shall indicate a pressure of <10.0 cmH_2O.

6.7C.6.4 Remove the test equipment. Readjust the scavenger needle valve to allow typical suction through the scavenger.

6.7D SUCTION REGULATOR

6.7D.1 Verify that the suction bottle is attached to the suction regulator.

6.7D.2 Verify that vacuum is attached to the ¾ in. DISS vacuum connection.

6.7D.3 Set the vacuum on/off valve to the OFF (vertical) position.

6.7D.4 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.

6.7D.5 Set the digital pressure meter to the mmHg scale.

6.7D.6 Turn the vacuum control knob fully counter-clockwise.

(✓) 6.7D.7 What is the vacuum indicated on the digital pressure meter? (0)

6.7D.8 Turn the vacuum control knob fully clockwise and verify that the vacuum control knob stops.

6.7D.9 Set the vacuum on/off valve to the ON position.

6.7D.10 Set the regulator to indicate 250 mmHg.

(✓) 6.7D.11 What is the vacuum indicated on the digital pressure meter? (200-300 mmHg)

6.7D.12 Return all controls to their original positions.

6.8 BREATHING SYSTEM

(✓) 6.8.1 Absorber System Inspection

6.8.1.1 Remove the inspiratory and the expiratory valve domes.

6.8.1.2 Is there a broken or bent pin on the valve assembly?
Inspiratory ___ (N) Expiratory ___ (N)

6.8.1.3 Is there a broken pin on the valve domes?
Inspiratory ___ (N) Expiratory ___ (N)

6.8.1.4 Is the valve disc in good condition?
Inspiratory ___ (Y) Expiratory ___ (Y)

6.8.1.5 Are the valve dome washers in good condition? ___ (Y)

6.8.1.6 Reinstall the inspiratory and expiratory valve domes.

6.8.1.6A Remove the ultrasonic flow sensor connector hose - if applicable.

6.8.1.6B Is the connector hose, connector, and O-ring in good condition? ___(Y) - if applicable.

6.8.1.6C Remove the ultrasonic flow sensor from the mounting bracket - if applicable.

6.8.1.6D Remove the flow housing/transducer assembly from the electronics housing - if applicable.

6.8.1.6E Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble - if applicable.

6.8.1.7 Remove the inspiratory and expiratory valve assemblies.

6.8.1.8 Remove the Spiromed sensor.

6.8.1.9 Are all three washers in good condition? ___ (Y)

6.8.1.10 Reinstall the inspiratory valve.

6.8.1.10A Reinstall the expiratory valve and the connector hose between the expiratory valve and the ultrasonic flow sensor - if applicable.

6.8.1.11 Are the two (2) spring clips on the absorber rods?
___ (Y)

6.8.1.12 Inspect the following: canisters and gaskets, dust cup and O-ring, condition of soda lime.

6.8.1.13 Are the absorber canisters and dust cup in good condition? ___ (Y)

6.8.1.14 Is the cm H_2O gauge at zero (0)? ___ (Y)

6.8.1.15 Remove the O_2Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

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6.8.1.16 Reinstall the O_2Med sensor plug into the inspiratory valve dome adapter.

6.8.1.17 Examine the two O-rings at the bottom of the sensor.

(✓) 6.8.2 Repack MAN/AUTO Selector Valve

[Does not apply to machines with later design selector valve.]

6.8.2.1 Remove the four screws securing the stick shift block to the selector valve body and remove the block.

6.8.2.2 Remove the spring and valve channel from the valve body.

6.8.2.3 Remove all residual lubricant from the valve channel.

6.8.2.4 Remove all residual lubricant from the valve body.

6.8.2.5 Apply a minimal amount of "stop cock" lubricant (Dow Corning High Vacuum Grease, P/N S4105908) to the tapered surface of the valve channel, and ensure complete coverage of lubricant.

6.8.2.6 Insert the valve channel into the valve body.

6.8.2.7 Insert the spring into the stick shift block.

6.8.2.8 Align the index pins on the stick shift block to the holes in the valve channel.

6.8.2.9 Secure the stick shift block to the selector valve body with the four screws that were previously removed.

6.8.2.10 Operate the selector valve handle and verify smooth movement.

(✓) 6.8.3 Lubrication, Spiromed Sensor - if applicable

6.8.3.1 Locate the four lateral holes at the sides of the Spiromed sensor marked by printed arrows.

CAUTION: Use only Sensor Lubrication Kit P/N 2218180 for the following procedure.

6.8.3.2 Remove the protective cover from the pipette and open the lubricant bottle.

6.8.3.3 Dip the tip of the pipette into the lubricant and draw one drop of lubricant into the pipette by pulling the pin upwards.

6.8.3.4 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop to inject lubricant into the hole.

6.8.3.5 Repeat the procedure on the three remaining holes.

6.8.3.6 Wipe any lubricant residue from the exterior of the sensor.

6.8.3.7 Reattach the sensor to the absorber top dome.

6.8.3.8 Reattach the expiratory valve to the sensor.

6.8.4 Freshgas Leak

6.8.4.1 Turn the System Power switch to STANDBY.

6.8.4.2 Remove the 15 mm connector from the FRESHGAS OUTLET.

6.8.4.3 Is the common gas outlet assembly in good condition? ___ (Y)

6.8.4.4 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.

6.8.4.5 Apply 50 cm H_2O of pressure to the system.

(✓) 6.8.4.6 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.8.4.7 Turn on the left mounted vaporizer to the first graduated marking.

6.8.4.8 Apply 50 cm H_2O of pressure to the system.

(✓) 6.8.4.9 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.8.4.10 Turn off the vaporizer.

6.8.4.11 Remove the test equipment from the Fresh Gas Outlet.

6.8.4.12 Turn the System Power switch to ON.

6.8.4.13 Open the O_2 flow control valve to 5 l/min., purge the system for 5 seconds, then close the O_2 flow control valve.

6.8.4.14 Turn the System Power switch to STANDBY.

(✓) 6.8.4.15 Turn on the center mounted vaporizer to the first graduated marking, repeat Steps 6.8.4.4 and 6.8.4.8 thru 6.8.4.14. ___ (>40 cm H_2O)

(✓) 6.8.4.16 Turn on the right mounted vaporizer to the first graduated marking, repeat Steps 6.8.4.4 and 6.8.4.8 thru 6.8.4.14. ___ (>40 cm H_2O)

6.8.4.17 Reconnect the 15 mm connector from the absorber system to the FRESHGAS OUTLET.

6.8.4.18 Is the FRESHGAS OUTLET label on the freshgas outlet? ___ (Y)

6.8.5 Breathing System Leak

6.8.5.1 Verify the System Power switch is at STANDBY.

6.8.5.2 Close all flow control valves.

6.8.5.3 Interconnect the inspiratory and expiratory valves with a 12-inch hose.

6.8.5.4 Attach a test terminal with a cuff inflation bulb (P/N S010159) to the bag mount.

6.8.5.5 Set the Man/Auto selector valve to BAG.

6.8.5.6 Close the APL valve.

6.8.5.7 Apply 50 cm H_2O pressure to the absorber system.

(✓) 6.8.5.8 After 30 seconds, what is the pressure in the absorber system? ___ cm H_2O ($\geq$30)

6.8.6 APL Valve

6.8.6.1 Open the APL valve to its stop.

6.8.6.2 Turn the SYSTEM POWER switch to ON.

6.8.6.3 Set the oxygen flow to 8 l/min.

(✓) 6.8.6.4 What is the pressure on the absorber pressure gauge? ___ cm H_2O ($\leq$3)

6.8.6.5 Close the oxygen flow control valve, turn the System Power switch to STANDBY, and remove the test terminal from the bag mount.

6.8.7 Absorber Flow Direction and Leak

6.8.7.1 Expiration Valve Leak

6.8.7.1.1 Close the APL valve.

6.8.7.1.2 Connect a 22mm hose between the inspiration valve and the bag mount.

6.8.7.1.3 Connect a test terminal to the expiration valve or the expirtory hose terminal on the ultrasonic flow sensor, if applicable.

6.8.7.1.4 Connect a Capnomed flowmeter to the test terminal.

6.8.7.1.5 Turn the System Power switch to ON, turn up the oxygen flow until the system pressurizes to 30 cmH_2O.

(✓) 6.8.7.1.6 What is the value indicated on the flowmeter? ___ (≤60ml/min).

6.8.7.1.7 Remove all test equipment, and turn the System Power switch to STANDBY.

6.8.7.2 Inspiration Valve Leak

6.8.7.2.1 Connect a test terminal to the inspiratory valve.

6.8.7.2.2 Connect a tee fitting (P/N 4109292) and calibrated pressure meter to the test terminal.

6.8.7.2.3 Connect a pressure bulb to the open port of the tee adapter.

6.8.7.2.4 Connect another test terminal to the bag connector.

6.8.7.2.5 Connect a Capnomed flowmeter to the test terminal on the bag mount.

6.8.7.2.6 Pressurize the system to 30 cmH_2O.

(✓) 6.8.7.2.7 What is the value indicated on the flow meter? ___ (≤60 ml/min).

6.8.7.2.8 Remove all test equipment.

6.8.7.3 Flow Direction

6.8.7.3.1 Attach a breathing circuit with a 3-liter bag at the Y-piece to the inspiration valve and expiration valve or the expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.8.7.3.2 Attach a 3-liter bag to the swivel bag mount.

6.8.7.3.3 Turn the System Power switch to ON.

6.8.7.3.4 Set the O_2 flow to 4 l/min.

6.8.7.3.5 Inflate the simulated lung by briefly using the O_2 Flush.

6.8.7.3.6 Partially open the APL valve.

6.8.7.3.7 Squeeze the breathing bag attached to the bag mount at a rate of approximately 10 BPM. Readjust the APL valve if required to properly ventilate the simulated lung.

(✓) 6.8.7.3.8 Observe the operation of each unidirectional valve disc at eye level and make sure the inspiratory valve disc raises only during the inspiration phase, and the expiratory valve raises only during the exhalation phase. Watch the valves until satisfied that both valves operate correctly, and move freely without sticking.

6.8.7.3.9 Remove the breathing circuit.

6.8.7.3.10 Open the APL valve.

(✓) 6.8.8 Absorber PEEP Valve w/By-Pass - if applicable

6.8.8.1 Connect a 12 in. hose between the inspiratory and expiratory valves, and set the O_2 flow to 5 l/min.

* 6.8.8.2 Place the PEEP bypass in the ON position.

6.8.8.3 Adjust the absorber PEEP valve clockwise to the maximum position.

6.8.8.4 Does the PEEP valve adjust smoothly? ___ (Y)

6.8.8.5 What is the maximum PEEP? ___ cm H_2O (15-22)

* 6.8.8.6 Place the PEEP bypass in the OFF position.

6.8.8.7 Does the PEEP return to ≤3 cm H_2O? ___(Y)

6.8.8.8 Adjust the absorber PEEP valve counterclockwise to its minimum position.

6.8.8.9 Close the O_2 flow control valve.

* These items apply only to machines with a PEEP by-pass.

6.8.9 Bain Circuit Adapter - if applicable

6.8.9.1 Close the APL valve by turning the knob fully clockwise.

6.8.9.2 Insert the O_2 sensor plug into the O_2 sensor inlet on the Bain Circuit.

6.8.9.3 Attach a test terminal with a cuff inflation bulb (P/N S010159) to the Breathing Bag port on the Bain Circuit.

6.8.9.4 Attach a cmH_2O digital pressure meter to the female quick connect connection on the Bain Circuit.

6.8.9.5 Occlude the expiration port on the Bain Circuit.

6.8.9.6 Apply 50cmH_2O to the Bain Circuit via test terminal and inflation bulb.

(✓) 6.8.9.7 After 30 seconds, what is the pressure on the cmH_2O digital pressure meter? (45 to 50 cmH_2O)

6.8.9.8 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O of the digital pressure meter reading.

6.8.9.9 Open the APL valve by turning the knob fully counter-clockwise.

6.8.9.10 Connect a test hose from the fresh gas outlet to the Expiration port of the Bain Circuit.

6.8.9.11 Set the O_2 flow to 10 L/min.

(✓) 6.8.9.12 What is the pressure on the cmH_2O digital pressure meter? (≤ 3 cmH_2O)

6.8.9.13 Verify that the pressure indicated on the cmH_2O gauge is within 3 cmH_2O of the digital pressure meter reading.

6.8.9.14 Remove the test terminal and inflation bulb from the Breathing Bag port.

6.8.9.15 Return all controls to their original positions.

(✓) 6.9 MANUAL SPHYGMOMANOMETER - if applicable

6.9.1 Insert the male Luer fitting of the Sphygmomanometer squeeze bulb-hose assembly into the female Luer fitting labeled BP BULB on the front of the machine.

6.9.2 Wrap the blood pressure cuff around an "E" cylinder.

6.9.3 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the Sphygmomanometer gauge on the machine. Pinch the hose adjacent to the Luer fitting to assure that the hose-bulb is not the source of any leak.

6.9.4 After thirty (30) seconds, what is the pressure on the Sphygmomanometer gauge? ___ mm Hg (190-200)

6.9.5 Bleed the pressure.

6.9.6 The Sphygmomanometer should indicate within the band.

6.9.7 Attach a test gauge in series with the sphygmomanometer gauge being tested.

6.9.8 Hand-pump the squeeze bulb until the machine gauge indicates 100 mm Hg.

6.9.9 What does the test gauge indicate? ___ mm Hg (90-110).

6.9.10 Hand-pump the squeeze bulb until the machine gauge indicates 200 mm Hg.

6.9.11 What does the test gauge indicate? ___ mm Hg (180-220).

6.9.12 Hand-pump the squeeze bulb until the machine gauge indicates 300 mm Hg.

6.9.13 What does the test gauge indicate? ___ mm Hg (210-390).

6.9.14 Remove the test gauge.

6.9.15 Remove the blood pressure cuff from the "E" cylinder.

(✓) 6.10 VAPOR EXCLUSION SYSTEM

6.10.1 Set all vapors to zero (0).

6.10.2 Adjust the handwheel on the left vapor (viewed from the front of the machine) to any concentration above zero (0).

6.10.3 Using the datagrip, select AGT.

6.10.4 Verify that the correct abbreviation for the agent selected appears on the display.

6.10.5 Is it possible to adjust the center vapor? ___ (N)

6.10.6 Is it possible to adjust the right (viewed from the front of the machine) vapor? ___(N)

6.10.7 Adjust the handwheel on the left vapor to zero (0).

6.10.8 Adjust the handwheel on the center vapor to any concentration above zero 0).

6.10.9 Verify that the correct abbreviation for the agent selected appears on the display.

6.10.10 Is it possible to adjust the left vapor? ___ (N)

6.10.11 Is it possible to adjust the right vapor? ___ (N).

6.10.12 Adjust the handwheel on the center vapor to zero (0).

6.10.13 Adjust the handwheel on the right vapor to any concentration above zero (0).

6.10.14 Verify that the correct abbreviation for the agent selected appears on the display.

6.10.15 Is it possible to adjust the left vapor? ___ (N).

6.10.16 Is it possible to adjust the center vapor? ___ (N).

6.10.17 Adjust the handwheel on the right vapor to zero (0).

6.11 YOKES & GAUGES

(✓) 6.11.1 Yokes & Check Valves

6.11.1.1 Turn the System Power switch to STANDBY.

6.11.1.2 Disconnect all pipeline hoses and close all cylinder valves.

6.11.1.3 Remove cylinder or yoke plug from each yoke assembly.

6.11.1.4 Do all the yoke handles adjust smoothly? ___ (Y)

6.11.1.5 Are the two (2) yoke pins installed securely in each yoke? ___ (Y)

6.11.1.6 Is there only one (1) cylinder washer on each yoke assembly? ___ (Y)

6.11.1.7 Is there a yoke plug attached to each yoke assembly? ___ (Y)

6.11.1.8 Is the proper gas I.D. label affixed to each yoke assembly? ___ (Y)

6.11.1.9 Attach a cylinder to each yoke assembly, open the cylinder valve, let the pressure stabilize, close the cylinder valve, and remove the cylinder from the yoke assembly.

6.11.1.10 Does the yoke check valve assembly prevent the escape of excessive pressure? ___ (Y)

6.11.1.11 Attach the cylinders to the yokes.

(✓) 6.11.2 Cylinder Gauges

6.11.2.1 Are the pressure gauges correct for the gases indicated by the flowmeters? ___ (Y)

6.11.2.2 Is the gauge closest to the table top for cylinder supply pressure? ___ (Y)

6.11.2.3 Bleed all pressure from the cylinder circuit.

6.11.2.4 Are the cylinder gauges at zero (0) PSI? ___ (Y)

6.11.2.5 Open the cylinder valves.

6.11.2.6 Do the cylinder pressure gauges respond properly? ___ (Y)

(✓) 6.11.3 Pipeline Gauges

6.11.3.1 Are the gauges right below the flowmeters for pipeline supply pressure? ___ (Y)

6.11.3.2 Are the pipeline pressure gauges at zero (0) PSI? ___ (Y)

6.11.3.3 Connect the pipeline supply.

6.11.3.4 Do the pipeline pressure gauges respond properly? ___ (Y)

6.11.3.5 Are the correct gas identification labels affixed at each of the pipeline inlets? ___ (Y)

6.11.3.6 Does the back panel identify each of the pipeline inlets properly? ___ (Y)

6.11.3.7 Disconnect the pipeline hoses.

6.12 HIGH PRESSURE REGULATOR

Minimum cylinder pressures for this test are: N2O & CO2: 600 psi
O2, Air, He, He/O2, N2: 1000 psi

6.12.1 Verify the System Power switch is ON.

6.12.2 Verify all cylinder valves are closed except the O_2 valve.

6.12.3 Set the oxygen flow to 4 liters per min.

6.12.4 Open the other gas flow control valves to drain pressure from the system.

6.12.5 Close the O_2 cylinder valve, and press the O_2 Flush valve to drain oxygen pressure from the system.

6.12.6 Turn the System Power switch to STANDBY.

6.12.7 Remove the table top from the machine and remove the top cabinet drawer. Refer to replacement procedure 4.2.

6.12.8 Locate the TEE fitting in the ¼ in. diameter O_2 regulator output line, and remove the plug from the TEE fitting.

6.12.9 Connect a dedicated O_2 test gauge to the TEE fitting.

NOTE: Two test gauges are required to avoid contamination of the O_2 circuit from the other gases: a dedicated test gauge for O_2, and a second test gauge for the other gases.

6.12.10 Open the O_2 cylinder valve. Turn the System Power switch to ON, and turn the gas selector switch to ALL GASES - if applicable.

6.12.11 Verify the oxygen flow is 4 liters per min.

(✓) 6.12.12 On the test gauge, what is the regulator output press.? ___PSI (43-49)

NOTE: Leave the dedicated O_2 test gauge connected for later use in the Oxygen Supply Pressure Alarm Test.

6.12.13 Turn the System Power switch to STANDBY.

6.12.14 For the other pressure regulators, locate their corresponding TEE fittings in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting (one at a time).

6.12.15 Connect the second test gauge to the TEE fitting.

6.12.16 Open the corresponding cylinder valve and set the System Power switch to ON.

6.12.17 Set the corresponding flow to 4 l/min.

(✓) 6.12.18 On the second test gauge, what is the regulator output pressure? ___ PSI (40 - 49 for N2O), (43 - 49 for Air)

6.12.19 Depressurize the gas circuit.

6.12.20 Remove the test gauge and replace the plug in the TEE fitting.

(✓) 6.12.21 Repeat Steps 6.12.13 thru 6.12.20 for all other gases except CO_2 circuits.

6.13 HIGH PRESSURE LEAK

(✓) 6.13.1 Oxygen High Pressure Leak

6.13.1.1 Verify the System Power switch is at STANDBY.

6.13.1.2 Open one (1) oxygen cylinder valve.

6.13.1.3 Let the pressure stabilize.

6.13.1.4 Close the oxygen cylinder valve and remove the cylinder.

6.13.1.5 Observe the oxygen cylinder pressure gauge.

6.13.1.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.13.1.7 Attach the cylinder.

(✓) 6.13.2 Nitrous Oxide High Pressure Leak

6.13.2.1 Turn the System Power switch to ON.

6.13.2.2 Open one (1) oxygen cylinder valve and one (1) nitrous oxide cylinder valve.

6.13.2.3 Adjust the oxygen flow to 4 l/min.

6.13.2.4 Let the pressure stabilize.

6.13.2.5 Close the nitrous oxide cylinder valve and remove the cylinder.

6.13.2.6 Observe the nitrous oxide cylinder pressure gauge.

6.13.2.7 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.13.2.8 Attach the cylinder.

6.13.2.9 Close the oxygen flow control valve.

(✓) 6.13.3 Air High Pressure Leak - if applicable

* 6.13.3.1 Set the gas selector switch to ALL GASES.

6.13.3.2 Open the air cylinder valve.

6.13.3.3 Let the pressure stabilize.

6.13.3.4 Close the air cylinder valve and remove the cylinder.

6.13.3.5 Observe the air cylinder pressure gauge.

6.13.3.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.13.3.7 Attach the air cylinder.

(✓) 6.13.4 Oxygen-Helium High Pressure Leak - if applicable

* 6.13.4.1 Set the gas selector switch to ALL GASES.

6.13.4.2 Open the oxygen-helium cylinder valve.

6.13.4.3 Let the pressure stabilize.

6.13.4.4 Close the oxygen-helium cylinder valve and remove the cylinder.

6.13.4.5 Observe the oxygen-helium cylinder pressure gauge.

6.13.4.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.13.4.7 Attach the oxygen-helium cylinder.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

(✓) 6.13.5 Carbon Dioxide High Pressure Leak - if applicable

* 6.13.5.1 Set the gas selector switch to ALL GASES.

6.13.5.2 Open the carbon dioxide cylinder valve.

6.13.5.3 Let the pressure stabilize.

6.13.5.4 Close the carbon dioxide cylinder valve and remove the cylinder.

6.13.5.5 Observe the carbon dioxide cylinder pressure gauge.

6.13.5.6 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.13.5.7 Attach the carbon dioxide cylinder.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14 OXYGEN SUPPLY FAILURE PROTECTION

6.14.1 Nitrous Oxide O.F.P.D.

6.14.1.1 Open and close the oxygen cylinder valve.

6.14.1.2 Open the nitrous oxide cylinder valve.

6.14.1.3 Set the O_2 and N_2O flows to 4 l/min.

(✓) 6.14.1.4 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.14.1.5 Connect the O_2 pipeline supply.

6.14.1.6 Close the nitrous oxide cylinder valve and bleed the pressure from the circuit.

6.14.1.7 Connect the N_2O pipeline supply.

6.14.1.8 Disconnect the O_2 pipeline supply.

(✓) 6.14.1.9 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.14.1.10 Close the nitrous oxide flow control valve.

6.14.1.11 Disconnect the N_2O pipeline supply.

6.14.2 Air O.F.P.D. - if applicable

* 6.14.2.1 Set the gas selector switch to ALL GASES.

6.14.2.2 Open the air cylinder valve - if applicable.

6.14.2.3 Connect the air pipeline hose - if applicable.

6.14.2.4 Open one (1) oxygen cylinder valve.

6.14.2.5 Set the air flow to 4 l/min; set the oxygen flow to 4 l/min.

6.14.2.6 Close the oxygen cylinder valve.

(✓) 6.14.2.7 Does the flow of air cease when the oxygen pressure is depleted? ___ (Y)

6.14.2.8 Close the air flow control valve.

6.14.2.9 Disconnect the air pipeline hose - if applicable.

6.14.3 Oxygen-Helium O.F.P.D. - if applicable

* 6.14.3.1 Set the gas selector switch to ALL GASES.

6.14.3.2 Open the oxygen-helium cylinder valve.

6.14.3.3 Open one (1) oxygen cylinder valve.

6.14.3.4 Set the oxygen-helium flow to 4 l/min; set the oxygen flow to 4 l/min.

6.14.3.5 Close the oxygen cylinder valve.

(✓) 6.14.3.6 Does the flow of oxygen-helium cease when the oxygen pressure is depleted? ___ (Y)

6.14.3.7 Close the oxygen-helium flow control valve.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14.4 Carbon Dioxide O.F.P.D. - if applicable

* 6.14.4.1 Set the gas selector switch to ALL GASES.

6.14.4.2 Open the cylinder of carbon dioxide.

6.14.4.3 Open one (1) oxygen cylinder valve.

6.14.4.4 Set the carbon dioxide flow to 500 ml; set the oxygen flow to 4 l/min.

6.14.4.5 Close the oxygen cylinder valve.

(✓) 6.14.4.6 Does the flow of carbon dioxide cease when the oxygen pressure is depleted? ___ (Y)

6.14.4.7 Close the carbon dioxide flow control valve.

* 6.14.4.8 Set the gas selector switch to O_2+N_2O.

6.14.5 (Deleted)

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.14.6 (Deleted)

6.14.7 Oxygen Supply Pressure Alarm

6.14.7.1 If not already connected, connect a dedicated O_2 test gauge to the TEE fitting in the O_2 regulator output line.

6.14.7.2 Open and close an oxygen cylinder.

6.14.7.3 Set the oxygen flow to 2 l/min.

(✓) 6.14.7.4 What is the pressure on the dedicated O_2 test gauge when the "O2 SUPPLY PRESSURE" LED turns on? ___ PSI (34 - 40)

6.14.7.5 Does the O2 SUPPLY LOW message appear in the Caution display? ___ (Y)

6.14.7.6 Bleed the remaining O_2 pressure from the system, then close the flow control valve.

6.14.7.7 Remove the test gauge from the TEE fitting in the O_2 regulator output line and replace the plug.

6.15 FLOWMETERS

(✓) 6.15.1 Oxygen Flowmeter

6.15.1.1 Open the O_2 cylinder valve.

6.15.1.2 Is it possible to adjust the flow of oxygen over the full range of the flowmeters? ___ (Y)

6.15.1.3 Close the O_2 cylinder valve and bleed the pressure.

6.15.1.4 Connect the O_2 pipeline supply, and verify the operation of the oxygen flowmeter.

6.15.1.5 Is the correct flow control knob and label attached to the oxygen flow control valve? ___ (Y)

6.15.1.6 Close the oxygen flow control valve.

* 6.15.1.7 Set the Gas Selector switch to the O_2 + N_2O position.

(✓) 6.15.1.8 What is the minimum flow of oxygen? ___ ml (100-200 ml/min); (0 ml for 4107615A (Minimum O_2 Flow Elimination))

(✓) 6.15.2 Nitrous Oxide Flowmeter

6.15.2.1 Set the oxygen flow to 4 l/min.

6.15.2.2 Open the nitrous oxide cylinder valve.

6.15.2.3 Is it possible to adjust the flow of nitrous oxide over the full range of the flowmeter? ___ (Y)

6.15.2.4 Close the nitrous oxide cylinder valve and bleed the pressure.

6.15.2.5 Connect the N_2O pipeline supply, and verify the proper operation of the N_2O flowmeter.

6.15.2.6 Is the correct flow control knob and label attached to the N_2O flow control valve? ___ (Y)

6.15.2.7 Close the oxygen and nitrous oxide flow control valves.

* These items do not apply to 2-gas machines or later design (P/N 4113329-001) ORC.

(✓) 6.15.3 Air Flowmeter - if applicable

* 6.15.3.1 Set the gas selector switch to ALL GASES.

** 6.15.3.2 Open the air cylinder valve.

** 6.15.3.3 Is it possible to adjust the flow of the air over the full range of the flowmeter? ___ (Y)

** 6.15.3.4 Close the air cylinder valve and bleed the pressure.

6.15.3.5 Close the air flow control valve.

6.15.3.6 Connect the Air pipeline supply and verify the proper operation of the air flowmeter. Close the air flow control valve.

6.15.3.7 Is the correct flow control knob and label attached to the air flow control valve? ___ (Y)

* 6.15.3.8 What is the minimum flow of oxygen? ___ ml (0)

(✓) 6.15.4 Oxygen-Helium Flowmeter - if applicable

* 6.15.4.1 Set the gas selector switch to ALL GASES.

6.15.4.2 Open the oxygen-helium gas cylinder valve.

6.15.4.3 Is it possible to adjust the flow of the oxygen-helium over the full range of the flowmeter? ___ (Y)

6.15.4.4 Close the oxygen-helium flow control valve.

6.15.4.5 Is the correct flow control knob and label attached to the oxygen-helium flow control valve? ___ (Y)

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

**these items do not apply to 4-gas machines.

(✓) 6.15.5 Carbon Dioxide Flowmeter - if applicable

* 6.15.5.1 Set the gas selector switch to ALL GASES.

6.15.5.2 Open the carbon dioxide gas cylinder valve.

6.15.5.3 Is it possible to adjust the flow of the carbon dioxide over its range of 600 ml/min.? ___ (Y)

6.15.5.4 Close the carbon dioxide flow control valve.

6.15.5.5 Is the correct flow control knob and label attached to the carbon dioxide flow control valve? ___ (Y)

*These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.16 O2 MED

6.16.1 Disconnect the oxygen sensor cable from the Oxygen Sensor interface.

6.16.2 The following message shall appear on the remote display: O2 SENS DISC.

6.16.3 Reconnect the O_2 Med sensor.

6.16.4 The following message shall appear on the remote display: CAL O2 SENSOR.

6.16.5 Press the Datagrip trigger, select SET UP and perform an O_2 calibration.

NOTE: Make sure that the sensor has been stabilized in ambient air for several minutes.

(✓) 6.16.6 After calibration is completed, what is the oxygen concentration? ___ % (21)

6.16.7 Select TEMPLATE and press the trigger, select GET TEMPLATE and enter the factory defaults.

6.16.8 The warning INSP O2 LOW shall appear on the remote display and the warning heading shall be flashing. There shall be a continuous audible alarm.

6.16.9 What is the low oxygen alarm default? ___ % (30)

6.16.10 Exit the Default screen and re-enter the SET UP screen.

6.16.11 Select the OXYGEN LOW alarm limit. Does a box appear around the low alarm limit? ___ (Y)

6.16.12 Verify that the low alarm limit has a range from 18 to 99%.

6.16.13 Place the oxygen sensor into the inspiratory valve dome adapter, set the Man/Auto selector BAG, close the APL valve. Attach a 12-inch hose to the inspiratory valve and occlude the bag mount.

6.16.14 Set the oxygen flow to 4 l/min.

6.16.15 Set the low limit to 18, and verify the INSP O2 LOW message has cleared.

6.16.16 Select the OXYGEN HIGH alarm limit. Does a box appear around the high alarm limit? ___ (Y)

6.16.17 What is the high oxygen alarm default? ___ % (100)

6.16.18 Verify that the high alarm limit has a range from 100 to 19%.

6.16.19 Set the high alarm limit to 95.

6.16.20 The message INSP O2 HIGH shall appear on the remote display under the Advisory column.

6.16.21 Return the high alarm limit to 100.

6.16.22 The INSP O2 HIGH message shall disappear.

(✓) 6.16.23 Within 3 minutes, what is the oxygen concentration? ___ % (97-100)

6.17 OXYGEN CONCENTRATIONS

6.17.1 Oxygen + Nitrous Oxide Concentration

6.17.1.1 Verify the oxygen flow is at 4 l/min.

6.17.1.2 Depress the O_2 Flush button for 5 seconds.

6.17.1.3 Does the O_2Med read 97-100% after the value stabilizes?__(Y)

6.17.1.4 Set the nitrous oxide flow to 2 l/min.

(✓) 6.17.1.5 After the value stabilizes, what is the oxygen concentration? ___ % (64-70)

6.17.1.6 Close the nitrous oxide flow control valve.

6.17.2 Oxygen + Air Concentration - if applicable

6.17.2.1 Depress the O_2FLUSH button for 5 seconds.

6.17.2.2 Does the O_2Med read 97-100% after the value stabilizes?__(Y)

* 6.17.2.3 Set the gas selector switch to ALL GASES.

6.17.2.4 Verify the O_2 flow is at 4 l/min; set the air flow to 2 l/min.

(✓) 6.17.2.5 After the value stabilizes, what is the O_2 concentration? ___%(71-77)

6.17.2.6 Close the air cylinder valve and bleed the pressure from the circuit - if applicable.

6.17.2.7 Close the air flow control valve.

* 6.17.2.8 Set the gas selector switch to O_2+N_2O.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.17.3 Oxygen + Helium and Oxygen Concentration - if applicable

6.17.3.1 Depress the "O_2 FLUSH" for 15 seconds.

6.17.3.2 Does the O_2 Med read 97-100% within 3 minutes? ___ (Y)

* 6.17.3.3 Set the gas selector switch to ALL GASES.

6.17.3.4 Verify the oxygen flow is at 4 l/min.

6.17.3.5 Set the oxygen-helium flow to 2 l/min.

(✓) 6.17.3.6 After the value stabilizes, what is the O_2 concentration? ___%(72-78)

6.17.3.7 Close the oxygen-helium cylinder valve and bleed the pressure from the circuit.

6.17.3.8 Close the oxygen-helium flow control valve.

* 6.17.3.9 Set the gas selector switch to O_2+N_2O.

6.17.4 Oxygen + Carbon Dioxide Concentration - if applicable

6.17.4.1 Depress the O_2FLUSH button for 15 seconds.

6.17.4.2 Set the oxygen flow to 1000 ml.

6.17.4.3 Does the O_2MED read 97-100% within 3 min?___(Y)

* 6.17.4.4 Set the gas selector switch to ALL GASES.

6.17.4.5 Set the carbon dioxide flow to 500 ml.

(✓) 6.17.4.6 What is the O_2 concentration after the value stabilizes? ___%(64-70)

6.17.4.7 Close the carbon dioxide cylinder valve and bleed the pressure from the circuit.

6.17.4.8 Close the carbon dioxide flow control valve.

* 6.17.4.9 Set the gas selector switch to O_2+N_2O.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

(✓) 6.18 AUXILIARY OXYGEN FLOWMETER - if applicable

6.18.1 Close the auxiliary oxygen flowmeter flow control valve.

6.18.2 Connect a cm H_2O pressure manometer to the outlet.

6.18.3 Is there an increase in pressure? ___ (N)

6.18.4 Apply a pressure of 50 cm H_2O to the manometer.

6.18.5 After 30 seconds, what is the pressure on the manometer? ___(>40 cm H_2O)

6.18.6 Remove the gauge and test fixture.

6.18.7 Is it possible to adjust the flow over the full range of the auxiliary oxygen flowmeter? ___ (Y)

6.18.8 Set the flow rate to 5 l/min.

6.18.9 Hold the sensor from a calibrated O_2Med at the auxiliary oxygen flowmeter outlet.

6.18.10 After the value stabilizes, what is the oxygen concentration? ___ % (97-100)

6.18.11 Remove the O_2Med sensor from the auxiliary oxygen flowmeter, and insert it into the inspiratory valve dome adapter.

6.18.12 Close the flowmeter flow control valve.

6.19A OXYGEN RATIO CONTROLLER

* 6.19A.1 Set the Gas Selector switch to O_2 + N_2O.

6.19A.2 Depress the O_2FLUSH for 5 seconds.

6.19A.3 Set the oxygen flow to 1000 ml/min.

6.19A.4 Open the nitrous oxide flow control valve to the stop position.

(✓) 6.19A.5 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19A.6 Adjust the oxygen flow to 1.5 l/min.

(✓) 6.19A.7 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19A.8 Adjust the oxygen flow to 2 l/min.

(✓) 6.19A.9 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19A.10 Adjust the oxygen flow to 4 l/min.

(✓) 6.19A.11 What is the oxygen concentration after the value stabilizes? ___ % (21-29)

6.19A.12 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

6.19A.13 Close the oxygen flow control valve.

(✓) 6.19A.14 What is the flow of nitrous oxide? ___ ml/min. (0) or 375-750 ml/min on machines with later design ORC (P/N 4113329-001)

6.19A.15 What is the oxygen concentration with the O_2 flow control valve closed?___% (>21)

6.19A.16 Close the nitrous oxide flow control valve.

* These items do not apply to machines with later design (P/N 4113329-001) ORC.

6.20 BAROMED

6.20.1 Disconnect the breathing pressure sensor line from the absorber.

6.20.2 Connect a test pressure gauge and syringe to the breathing pressure sensor line.

6.20.3 Enter the SET UP screen, and select the THRESHOLD PRES alarm limit. Does a box shall appear around the Threshold Alarm Limit? ___ (Y).

6.20.4 What is the threshold alarm default? ___ cm H_2O (12)

6.20.5 Verify that the threshold alarm limit has a range from 5 to 30 cm H_2O.

6.20.6 Adjust the threshold to 10 cm H2O.

6.20.7 Select the PRESSURE HIGH alarm limit. Does a box shall appear around the High Pressure Alarm Limit? ___ (Y)

6.20.8 What is the high alarm limit default? ___ cm H_2O (50)

6.20.9 Verify that the high alarm limit has a range from 30 to 120 cm H_2O.

6.20.10 Set the high alarm limit to 65 cm H_2O, and exit from the set up menu.

6.20.11 Increase the pressure to 25 cm H_2O, then decrease the pressure to 20 cm H_2O.

6.20.12 Does the THRESHOLD LOW message appear in the Advisory column? ___ (Y)

6.20.13 Set the Man/Auto valve to AUTO, and turn the ventilator ON.

6.20.14 Bleed the pressure and start a stopwatch.

(✓) 6.20.15 What is the time when APNEA-PRESSURE appears in the Caution column? ___ sec (13-17)

(✓) 6.20.16 What is the time when the APNEA-PRESSURE appears in the Warning column? ___ sec (26-34)

6.20.17 After the APNEA-PRESSURE alarm is displayed in the Warning column on remote display, slowly increase the test pressure.

(✓) 6.20.18 At what pressure does the APNEA-PRESSURE alarm deactivate? ___ cm H_2O (7-13)

6.20.19 Adjust the threshold to 18 cm H_2O.

6.20.20 Increase the pressure to 20 cm H_2O, maintain the pressure, and start a stopwatch.

(✓) 6.20.21 What is the time when CONTINUOUS PRES appears in the Warning column? ___ sec (12-18)

(✓) 6.20.22 Decreasing the pressure slowly, what is the pressure at which the CONTINUOUS PRES alarm deactivates? ___ cm H_2O (15-21)

6.20.23 Slowly increase the pressure.

(✓) 6.20.24 At what pressure does the VENT PRESSURE HI alarm activate? ___ cm H_2O (62-68)

6.20.25 Bleed the pressure.

6.20.26 Slowly create a sub-atmospheric pressure.

(✓) 6.20.27 At what pressure does the SUB ATM PRESSURE alarm activate? ___ cm H_2O (-7 to -13)

6.20.28 Disconnect the test gauge and syringe; reconnect the breathing pressure sensor line to the absorber.

6.20.29 Does the SUB ATM PRESSURE alarm deactivate? ___(Y)

6.20.30 Enter the SET UP screen, select APNEA ALARM and select OFF.

6.20.31 Select PRESSURE SCALE and verify selections of 0-20, 0-50 and 0-100.

6.20.32 Verify that the APNEA ALARM cannot be selected to OFF when the ventilator switch is ON.

6.21 VENTILATOR

NOTE: Set the Pressure Limit control to MAX, and the PEEP valve to the minimum position, if applicable. Readjustment of INSPIRATORY FLOW to limit the inspiritory plateau may be required to reduce erratic tidal volumes and breath rates caused by artifact volume.

** 6.21.1 Set the Man/Auto selector to BAG.

6.21.2 Set the FREQUENCY to 10 BPM.

6.21.3 Set the I:E RATIO to 1:2.

6.21.4 Set the Tidal Volume to 1000 ml.

6.21.5 Attach a patient circuit to the absorber system.

6.21.6 Adjust the O_2 flow to 3 l/min.

6.21.7 Is the APNEA-P ALARM OFF message displayed in the Advisory column? (Y) (if no, press the APNEA ALARMS DISABLE key in the Pressure Alarms section of the main keypad.

6.21.8 Is the VOL-ALARMS OFF message displayed in the Advisory column? (Y) (if no, press the VOLUME ALARMS DISABLE key in the Minute Volume Alarms section of the main keypad.

6.21.9 Turn the ventilator on.

** 6.21.10 Verify the FAULT indicator turns on (Y)

6.21.11 Set the Man/Auto selector switch to AUTO.

** 6.21.12 Verify the FAULT indicator turns off (Y)

6.21.13 Do the APNEA-P ALARM OFF and VOL-ALARMS OFF messages disappear from the Advisory column? (Y)

6.21.14 Adjust the INSPIRATORY FLOW to the maximum of the LOW zone.

6.21.15 Occlude the Y-piece with your thumb.

6.21.16 Inflate the bellows by momentarily pressing the O_2 Flush.

(✓) 6.21.17 What is the peak inspiratory pressure? ___ cm H_2O (>30 cm H_2O)

6.21.18 Attach a test lung to the Y-piece.

** These items only apply to machines with an AV2+ ventilator.

6.21.19 Using a stopwatch, time the inspiratory phase.

(✓) 6.21.20 What is the inspiratory time? ___ seconds (1.8-2.2)

6.21.21 Using a stopwatch, time the expiratory phase.

(✓) 6.21.22 What is the expiratory time? ___ seconds (3.6-4.4)

** 6.21.23 Press and hold the EXTENDED RANGE switch and scroll the I:E ratio dial counter-clockwise and verify the extended I:E values increment (2:1, 3:1 and 4:1); return the I:E ratio to 2:1.

** 6.21.24 Using a stopwatch, time the inspiratory phase.

(✓) ** 6.21.25 What is the inspiratory time? ___ seconds (3.6 - 4.4)

** 6.21.26 Using a stopwatch, time the expiratory phase.

(✓) ** 6.21.27 What is the expiratory time? ___ seconds (1.8 - 2.2)

(✓) 6.21.28 Adjust the FREQUENCY and I:E RATIO through the following settings and verify that the ventilator cycles properly:

FREQ.	I:E RATIO	FREQ.	I:E RATIO	FREQ.	I:E RATIO
11	1:1	44	1:2.5	77	1:4
22	1:1.5	55	1:3	88	1:4.5
33	1:2	66	1:3.5	99	1:4.5

6.22 BELLOWS DRIVE GAS LEAK: ADULT

6.22.1 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.22.2 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.22.3 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.22.4 Set the FREQUENCY to 1 BPM.

6.22.5 Set the I:E RATIO to 1:1.

6.22.6 Set the INSPIRATORY FLOW to the maximum.

(✓) 6.22.7 What is the flow indicated during the inspiratory phase? ___ (<50 ml)

6.22.8 Remove the test terminal and flowmeter test stand.

6.22.9 Turn the ventilator and all ventilation alarms OFF.

6.23 SPIROMED or Ultrasonic Flow Sensor

6.23.1 Enter the SET UP screen and select the MINUTE VOLUME LOW alarm limit. Does a box appear around the Minute Volume Alarm Limit? ___(Y)

6.23.2 What is the low minute volume alarm default? ___ (1.0)

6.23.3 Verify that the minute volume has a low alarm limit range from at least 0.5 to 10.0 by increments of 0.1. (0.2 to 10.0 on later versions)

6.23.4 Adjust the low minute volume alarm to 2.0 liters.

6.23.5 Set VOLUME ALARMS to OFF, and exit the set up menu. Turn on the ventilator and start a stopwatch.

(✓) 6.23.6 What is the time when APNEA-VOLUME appears in the Caution column? ___ sec (13 - 17)

(✓) 6.23.7 What is the time when APNEA-VOLUME appears in the Warning column? ___ sec (26 - 34)

(✓) 6.23.8 Within one (1) minute, does the MINUTE VOLUME LOW message appear in the Caution column? ___ Y

6.23.9 Insert a test minute volumeter in between the Spiromed sensor (or absorber, if the system is equipped with the ultrasonic flow sensor) and the exhalation valve.

6.23.10 Reconnect the ventilator hose to the Ventilator Hose terminal.

6.23.11 Adjust the FREQUENCY to 6 BPM.

6.23.12 Adjust the I:E RATIO to 1:2.

6.23.13 Adjust the flow to the maximum of the LOW zone.

6.23.14 Adjust the oxygen flow to 2 l/min.

6.23.15 Adjust the Tidal Volume to 200 ml.

6.23.16 After the first breath is detected, does the APNEA-VOLUME in the Warning column and the MINUTE VOLUME LO in the Caution column deactivate? ___ (Y)

6.23.17 Adjust the low alarm limit above the indicated minute volume.

6.23.18 Does the MINUTE VOLUME LO message appear in the Caution column? ___ (Y)

6.23.19 Adjust the low alarm limit below the indicated minute volume.

6.23.20 Does the MINUTE VOLUME LO message in the Caution column deactivate? ___ (Y)

6.23.21 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.

6.23.22 Press the O_2 Flush momentarily to inflate the bellows.

6.23.23 Readjust the inspiratory flow as necessary to fully collapse the bellows.

(✓) 6.23.24 Are the tidal and minute volumes on the Spiromed (or ultrasonic flow sensor) and on the test volumeter within 20% of each other? ___ (Y)

6.23.25 Create a reverse flow by loosening the expiratory valve dome. If equipped with an ultrasonic flow sensor, remove the breathing hose from the flow sensor. Connect a test terminal and a Riken aspirator (negative pressure squeeze bulb) to the 22 mm male port of the flow sensor.Disconnect the hose attached to the exhalation valve. Compress and release the aspirator.

(✓) 6.23.26 Each time a reverse flow greater than 20 ml is detected, does the REVERSE FLOW message appear in the Advisory column? ___ (Y)

6.23.27 Tighten the expiratory valve dome. If equipped with an ultrasonic flow sensor, remove the test terminal and aspirator from the flow sensor and reconnect the patient circuit hose. Reconnect the hose between the expiratory valve and the flow sensor.

6.23.28 Disconnect the respiratory volume sensor cord from the VOLUME SENSOR interface.

6.23.29 Do the VOL SENSOR DISC and VOL ALARMS OFF messages appear in the Advisory column? ___ (Y)

6.23.30 Reconnect the respiratory volume sensor cord to the Volume Sensor interface and verify that the alarms clear.

6.23.31 Select MINUTE VOL SCALE and verify selections of 0-5, 0-10 and 0-20.

6.24A BELLOWS: ADULT - if applicable

6.24A.1 Set the FREQUENCY to 10 BPM.

6.24A.2 Set the I:E RATIO to 1:2.

6.24A.3 Adjust the O_2 flow to 300 ml/min.

6.24A.4 Adjust the INSPIRATORY FLOW to MED.

6.24A.5 Adjust the Tidal Volume to 200 ml.

6.24A.6 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.24A.7 What is the Tidal Volume on the test volumeter? ___ ml (125-250)

6.24A.8 Adjust the Tidal Volume to 1000 ml, and the fresh gas flow to 3 L/min.

6.24A.9 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.24A.10 What is the Tidal Volume on the test volumeter? ___ ml (900-1100)

6.24A.11 Adjust the O_2 flow to 5 l/min.

6.24A.12 Adjust the Tidal Volume to maximum.

6.24A.13 Remove the test lung and attach a 3 liter breathing bag. Adjust the INSPIRATORY FLOW to fully compress the bellows.

NOTE: Bag should be placed on a flat horizontal surface to reduce artifact volume.

(✓) 6.24A.14 What is the Tidal Volume on the test volumeter? ___ ml (≥1400)

6.24B VENTILATOR RELIEF VALVE: ADULT

6.24B.1 Adjust the O_2 flow to 10 l/min.

6.24B.2 Adjust the INSPIRATORY FLOW to MED.

6.24B.3 Adjust the I:E RATIO to 1:3, and the FREQUENCY to 10.

6.24B.4 Adjust the Tidal Volume to 1200 ml.

(✓) 6.24B.5 What is the PEEP? ___ cm H_2O (≤3)

6.24B.6 Adjust the O_2 flow to 500 ml.

(✓) 6.24B.7 Does the ventilator deliver the full Tidal Volume during 5 consecutive cycles? ___ (Y)

6.24B.8 Does the bellows stop adjust smoothly? ___ (Y)

6.25A BELLOWS: PEDIATRIC EXTERNAL - if applicable

6.25A.1 Set the ventilator frequency to 10 BPM.

6.25A.2 Set the I:E Ration to 1:2.

6.25A.3 Adjust the tidal volume to 300 ml/min.

6.25A.4 Turn the ventilator ON.

6.25A.5 Adjust the Inspiratory Flow control on the ventilator to Medium.

6.25A.6 Adjust the fine flow control of the Ped Bellows attachment fully clockwise.

6.25A.7 Set the O_2 to 3 l/min.

6.25A.8 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O_2 Flush button.

6.25A.9 Observe the absorber breathing pressure gauge as the ventilator cycles.

6.25A.10 What is the pressure when the bellows completes its downward travel? ___cmH_2O >30

6.25A.11 What is the pressure when the bellows completes its upward travel? ___cmH_2O ≤3

6.25A.12 Attach a test lung to the patient circuit Y-piece.

6.25A.13 Fill the bellows by pressing the O_2 Flush button.

6.25A.14 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration. Readjust the knob to the fully clockwise position.

6.25A.15 Adjust the O_2 flow to 10 l/min.

(✓) 6.25A.16 What is the PEEP? ___cmH_2O (≤3)

6.25A.17 Adjust the O_2 flow to 500 ml/min.

(✓) 6.25A.18 Does the ventilator deliver the full tidal volume during 5 consecutive cycles? ___(Y)

6.25A.19 Set the ventilator frequency to 20 BPM, and the I:E ration to 1:1.

6.25A.20 Adjust the O_2 flow to 3 l/min.

(✓) 6.25A.21 What is the tidal volume on the test volumeter? ___ml (>250)

6.25A.22 Remove the ventilator hose from the ventilator hose terminal.

6.25A.23 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.25A.24 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.25A.25 Set the frequency to 1 BPM.

6.25A.26 Set the I:E RATIO to 1:1.

(✓) 6.25A.27 What is the flow indicated during the inspiratory phase? ___(<50 ml)

6.25A.28 Remove the test terminal and flowmeter test stand.

6.25A.29 Return all controls to their original position.

6.25B BELLOWS: PEDIATRIC INTERNAL - if applicable

6.25B.1 Set the ventilator frequency to 10 BPM.

6.25B.2 Set the I:E Ratio to 1:2.

6.25B.3 Turn the ventilator ON.

6.25B.4 Adjust the Inspiratory Flow control on the ventilator to Medium.

6.25B.5 Set the O_2 to 3 l/min.

6.25B.6 Occlude the 15mm patient side of the Y-piece and fill the bellows by pressing the O_2 Flush button.

6.25B.7 Observe the absorber breathing pressure gauge as the ventilator cycles.

6.25B.8 What is the pressure when the bellows completes its downward travel? ___cmH_2O >30

6.25B.9 What is the pressure when the bellows completes its upward travel? ___cmH_2O ≤3

6.25B.10 Install a 3 L breathing bag onto the patient circuit Y-piece.

6.25B.11 Fill the bellows by pressing the O_2 Flush button.

6.25B.12 Adjust the O_2 flow to 10 l/min.

(✓) 6.25B.13 What is the PEEP? ___cmH_2O (≤3)

6.25B.14 Adjust the O_2 flow to 500 ml/min.

6.25B.15 Adjust the inspiratory flow control until the bellows collapses entirely.

(✓) 6.25B.16 Does the ventilator deliver the full tidal volume during 5 consecutive cycles? ___(Y)

6.25B.17 Set the ventilator frequency to 20 BPM, and the I:E ratio to 1:1.

6.25B.18 Adjust the O_2 flow to 3 l/min.

6.25B.19 Adjust the inspiratory flow control until the bellows collapses to the 100 ml mark on the pediatric bellows assembly.

(✓) 6.25B.20 What is the tidal volume on the test volumeter? ___ml (65-135)

6.25B.21 Adjust the inspiratory flow control until the bellows collapses entirely.

(✓) 6.25B.22 What is the tidal volume on the test volumeter? ___ml (>240)

6.25B.23 Close the O_2 flow control valve.

6.25B.24 Remove the ventilator hose from the ventilator hose terminal.

6.25B.25 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.25B.26 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.25B.27 Set the frequency to 1 BPM.

6.25B.28 Adjust the INSPIRATORY FLOW to maximum.

(✓) 6.25B.29 What is the flow indicated during the inspiratory phase? ___(<50 ml)

6.25B.30 Remove the test terminal and flowmeter test stand.

6.25B.31 Return all controls to their original position.

6.26 TRACE & TREND

(✓) 6.26.1 Trace: Verify that the display tracks the Breathing Pressure and Volume waveforms.

(✓) 6.26.2 Trend: Select VENT, and select SCROLL TREND, roll selection dial to the right and verify that Breathing Pressure, Volume and O_2 concentration trend information is available.

6.26.2.1 Turn the ventilator OFF.

6.27 PRESSURE LIMIT CONTROLLER (AV-2, AV-2+, or optional PLC, if applicable)

6.27.1 Turn the ventilator ON.

6.27.2 Set the Inspiratory Flow to the bottom of the low range.

6.27.3 Set the oxygen flow rate to 4 l/min.

6.27.4 Set the Pressure Limit Control to the MAX position.

6.27.5 Occlude the Y-piece with your thumb.

(✓) 6.27.6 Slowly increase the Inspiratory Flow setting until a peak pressure of 80 cm H_2O is achieved.

6.27.7 Set the Pressure Limit Control to 30.

(✓) 6.27.8 What is the peak pressure? ___ cm H_2O (27-33)

6.27.9 Set the Pressure Limit Control to the Min position.

(✓) 6.27.10 What is the peak pressure? ___ cm H_2O (<15)

6.27.11 Remove your thumb from the Y-piece.

6.27.12 Set the Inspiratory Flow to the maximum of the LOW zone.

6.27.13 Close the oxygen flow control valve.

6.27.14 Turn the ventilator OFF.

6.28 This section intentionally left blank

(✓) 6.29 AUDIO SILENCE

6.29.1 Turn the System Power switch to STANDBY, then turn it ON.

6.29.2 Verify the 120-sec. delay at power-up and allow a full countdown.

6.29.3 Create any warning alarm.

6.29.4 Press the key labeled with a crossed-out speaker.

6.29.5 Does the "SILENCE 120" message appear on the display? Is the audio alarm silenced during the count down? ___ (Y)

6.29.6 Does the "SILENCE" count down to 0 and then disappear? ___ (Y)

6.30 OXYGEN FLUSH VALVE

6.30.1 Press and release the O_2FLUSH button.

6.30.2 Does the flow of oxygen stop immediately? __ (Y)

6.30.3 Close the APL valve.

6.30.4 Connect a 12-inch hose to the inspiratory valve.

6.30.5 Set the Man/Auto selector to BAG.

6.30.6 Occlude the bag mount.

6.30.7 Insert the sensor from a calibrated O_2 Med into the valve dome adapter on the inspiratory valve.

6.30.8 Close all flow control valves.

6.30.9 Press the O_2FLUSH button.

(✓) 6.30.10 What is the O_2 concentration after the value stabilizes?___%O_2 (97-100)

6.30.11 Remove the O_2 Med sensor and install the plug.

6.30.12 Remove the test minute volumeter (P/N 2212300) from the absorber and connect it to the common gas outlet, using Fresh Gas Outlet Volume Test Device (P/N S010158).

6.30.13 Press and hold the O_2 FLUSH button for 15 seconds; multiply the value by 4.

(✓) 6.30.14 What is the oxygen flush flow rate? ___l/min. (45-65)

6.30.15 Remove the test minute volumeter and test fixture, and reconnect the fresh gas hose.

6.30.16 Turn the System Power switch to ON.

6.31 FINAL TESTS

(✓) 6.31.1 Operator's Instruction Manual

6.31.1.1 Verify that the availability/location of the machine's Operator's Instruction Manual is in close proximity of the machine.

(✓) 6.31.2 Auxillary Lamp - if applicable

6.31.2.1 Verify that the lamp head (shroud) can move approximately 90°.

6.31.2.2 Verify that the lamp head (shroud) can be positioned at any point within the 90° range and holds fast.

6.31.2.3 Verify that the lamp can rotate 360° and hits a stop located within 45° on either side of the top center point.

6.31.2.4 Verify that the lamp is plugged into a live AC receptacle.

6.31.2.5 Turn the lamp ON.

6.31.2.6 Adjust the dimmer control and verify that the light varies with the adjustment of the knob.

6.31.2.7 Turn the lamp OFF.

(✓) 6.31.3 Final Check

6.31.3.1 Verify that all cylinder pressure gauges indicate zero.

6.31.3.2 Verify that the pipeline hoses are connected to the hospital pipeline.

6.31.3.3 Verify that the APL valve knob is turned completely counter-clockwise (fully open).

6.31.3.4 Place the Auto/Man selector in the BAG position.

6.31.3.5 Verify that the O_2Med sensor is removed from the valve dome adapter.

6.31.3.6 Verify that the valve dome is plugged.

6.31.3.7 Verify that the machine is plugged into a live outlet.

6.31.3.8 Return all machine controls and settings to their original state.

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7.0 SOFTWARE UPDATE PROCEDURE

This section outlines several software installation methods, and also describes the operation of the Service Software Toolkit (SST).

The Service Software Toolkit (SST) allows all service constants, configurations, logs and templates to be saved to a disk for later viewing or adding to a service report. These same constants can be reloaded after a processor has been replaced. The SST can also be used to install Narkomed 2C software. Actual servicing of the machine is performed manually without the use of SST.

Software updates to the Narkomed 2C anesthesia system, including communication protocols for external monitors are done through a serial port connection to an external PC or through the O.R. Data Manager (ORDM). The software can be downloaded to the PC via modem, or furnished on a floppy disk.

Following is a summary of the software installation methods described in this section:

-- From an external PC using the batch file LOADNM2C.BAT. Initial installation will install the SpaceLabs Datalogger, Marquette Tram Net, Datex AS3, and Criticare POET IQ protocols.

-- From the ORDM. Initial installation will install the SpaceLabs Datalogger, Marquette Tram Net, Datex AS3, and Criticare POET IQ protocols.

-- From an external PC using the SST. Any desired protocols may be selected.

-- From the ORDM using the SST. Any desired protocols may be selected.

7.1 SOFTWARE TRANSFER TO PC VIA MODEM

Equipment required:

--Interface Cable, NAD Part No. 4109882 P (9-pin to 25-pin)
or 4110328 A (9-pin to 9-pin)
--IBM® PC or IBM PC Compatible configured with:

- PC-DOS or MS-DOS V3.3 or higher
- RS-232C Serial Port connected to COM 1
- Hard Drive or Floppy Drive
- Modem (or external modem)

7.1.1 Call the NAD Technical Service Department and obtain the following information for downloading NARKOMED 2C software:

- System configuration
- Communications protocol

7.1.2 Download the software to the hard disk or to Drive A on the PC.

7.2 INSTALLING NM2C SOFTWARE FROM A PC

7.2.1 Set the System Power switch on the NARKOMED 2C to STANDBY, and the power switch on the PC to OFF.

7.2.2 Connect the appropriate interface cable (9-pin or 25-pin) to COM 1 on the PC, and connect the other end of the cable to the NM2C serial interface Port A as shown in Figure 7-1.

7.2.3 Press and hold the SILENCE and AUTOSET keys on the remote display, and turn the System Power switch to ON. Release the keys when the load mode screen shown in Figure 7-2 appears.

7.2.4 Power up the PC and wait for the DOS prompt to appear on the screen.

7.2.5 Set the PC to read the drive holding the software. For example: if the software was downloaded to drive A, type A: and press ENTER.

7.2.6 Type LOADNM2C and press ENTER.

Software installation is complete when the machine resets.

7.2.7 Set the System Power switch on the NM2C to STANDBY, and the power switch on the PC to OFF. Disconnect the interface cable.

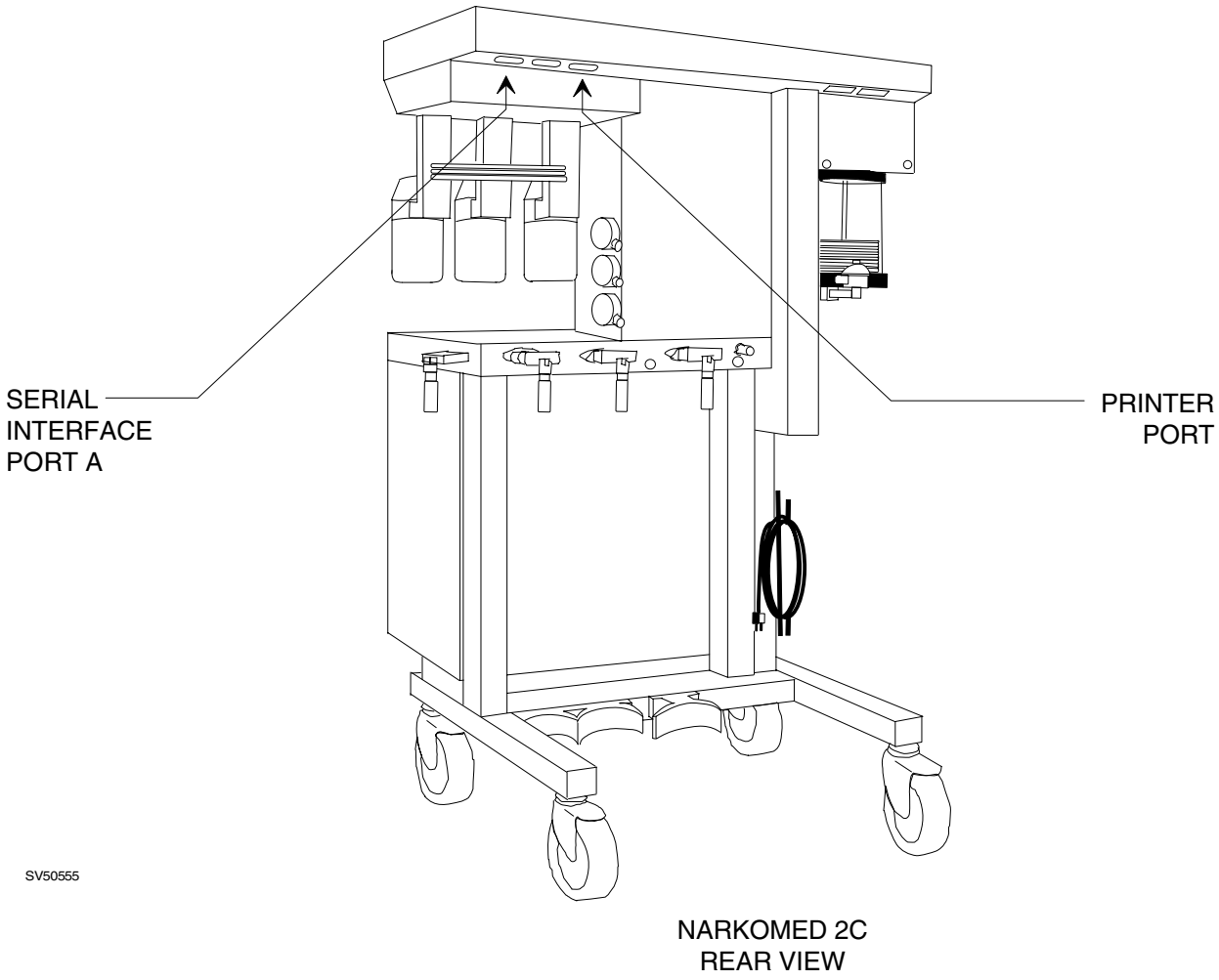


Figure 7-1: NARKOMED 2C EXTERNAL SOFTWARE LOAD INTERFACE CONNECTION

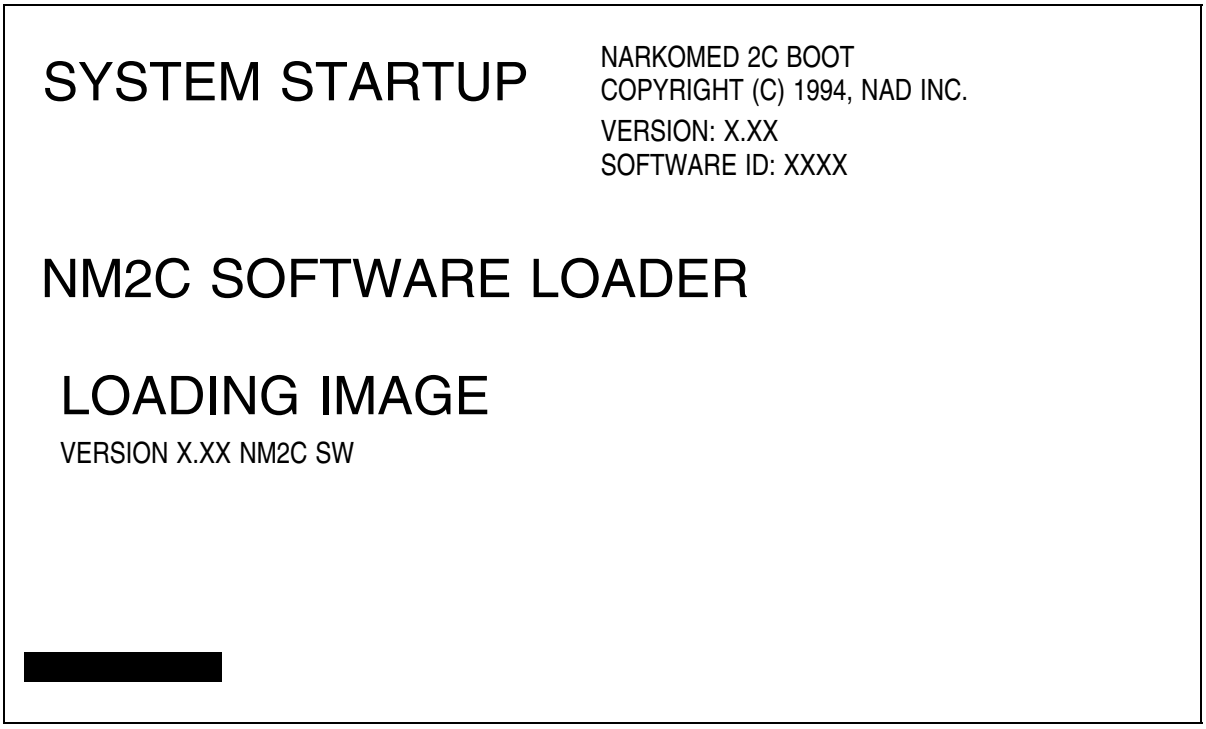


FIGURE 7-2: NARKOMED 2C LOAD MODE SCREEN

7.3 INSTALLING NM2C SOFTWARE FROM THE ORDM

To install NM2C software from an ORDM, a 3½ in. floppy disk with the Narkomed 2C software is needed.

7.3.1 Insert the floppy disk into the ORDM.

7.3.2 Set the System Power switch on the Narkomed 2C to STANDBY.

7.3.3 Press and hold the SILENCE and AUTOSET keys on the remote display, and turn the System Power switch to ON. Release the keys when the load mode screen shown in Figure 7-2 appears.

Software installation is complete when the machine resets.

7.4 INSTALLING NM2C SOFTWARE FROM A PC USING THE SST

Running the SST from an external computer requires an IBM® PC or IBM PC compatible configured with:

PC-DOS or MS-DOS V3.3 or higher
RS-232C Serial Port connected to COM 1
Hard Drive or 3½ in. Floppy Drive

The COM 1 port on the PC must be configured as follows:

Baud Rate:	9600	Stop Bits:	1
Parity:	None	Data Bits:	8

The download port (Port A) on the NM2C must be set to Vitalink and be configured as follows:

Baud Rate:	9600	Stop Bits:	1
Parity:	None	Data Bits:	8

7.4.1 Verify that the System Power switch on the machine is set to STANDBY, and that the power switch on the PC is OFF.

7.4.2 Connect a 30 in. long Vitalink cable (P/N 4110328) to COM 1 on the PC, and connect the other end of the cable to Port A on the Narkomed 2C (ref. Figure 7-1).

7.4.3 Turn the System Power switch to ON, and turn the PC ON.

7.4.4 At the DOS prompt, type SST; the SST Main Menu appears (Figure 7-3).

7.4.5 Select ENTER PRIMARY SERVICE from the SST main menu.

7.4.6 Select Load System Software from the Primary Service menu (Figure 7-8); The software load screen shown in Figure 7-9 appears.

7.4.7 Select the desired protocols, and press ESC or F10; follow the on-screen instructions to download the software.

Software installation is complete when the machine resets.

7.4.8 Set the System Power switch on the NM2C to STANDBY, and the power switch on the PC to OFF. Disconnect the interface cable.

7.5 INSTALLING NM2C SOFTWARE FROM THE ORDM USING THE SST

In order to run the SST from an ORDM, a 3½ in. floppy disk with Narkomed 2C SST software is needed.

7.5.1 Insert the NM2C SST disk into the ORDM floppy disk drive.

-- Turn the System Power switch to STANDBY, then return the switch to ON.

-- Wait for several minutes until the remote display screen displays the SST Main menu (Figure 7-3).

7.5.2 Select ENTER PRIMARY SERVICE from the SST main menu.

7.5.3 Select Load System Software from the Primary Service menu (Figure 7-8); The software load screen shown in Figure 7-9 appears.

7.5.4 Select the desired protocols, and press ESC on the ORDM keyboard; follow the on-screen instructions to download the software.

Software installation is complete when the machine resets.

7.6 SST Operation

The SST Main Menu shown in Figure 7-3 appears on the remote display (or external PC).

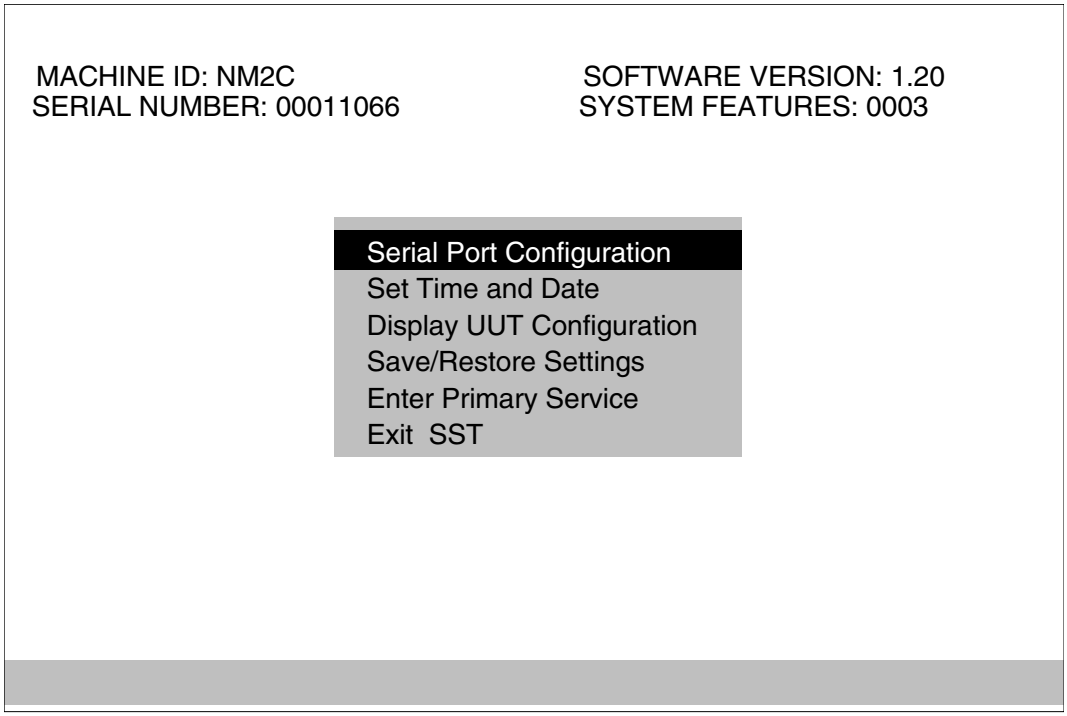


Figure 7-3: SST MAIN MENU

In the upper left corner of the screen, MACHINE ID indicates the Narkomed 2C is under test (NM2C), and the SERIAL NUMBER of the machine is displayed.

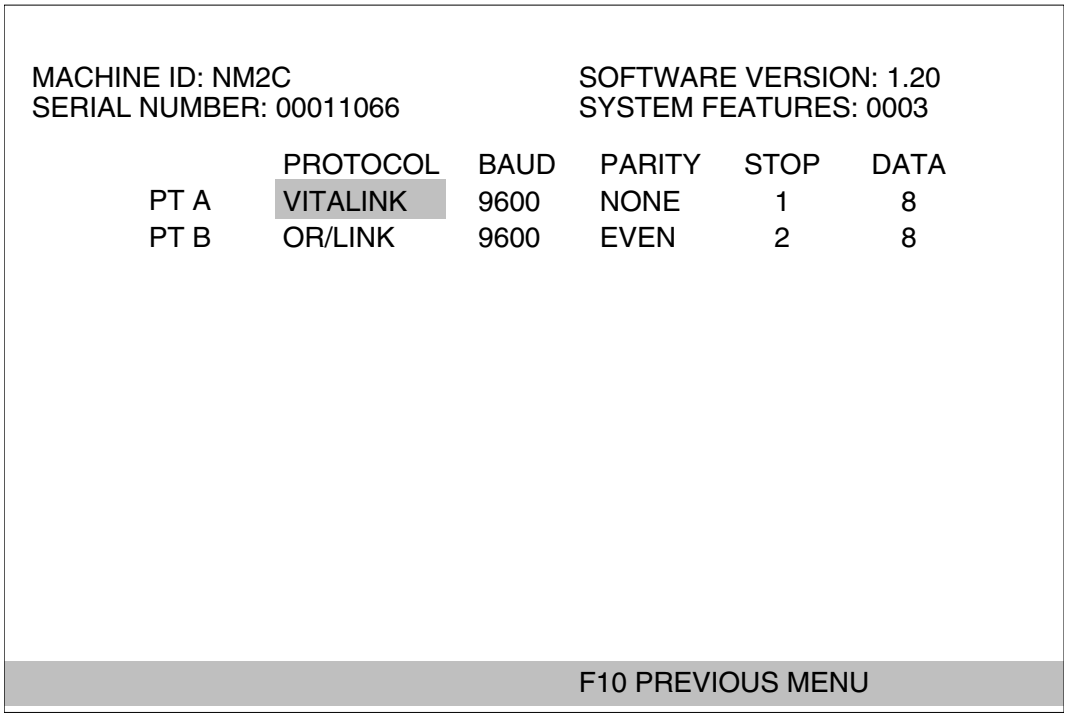
The service functions that are available through the SST main menu are described on the following pages.

To terminate the SST program, move the cursor to EXIT SST with the down arrow key and press ENTER.

7.6.1 Serial Port Configuration

The screen shown in Figure 7-4 indicates the current configuration parameters for each of the Narkomed 2C serial ports, and also allows changing of these settings.

-- At the SST Main Menu, set the cursor to SERIAL PORT CONFIGURATION and press ENTER to display the Serial Port Configuration screen.


MACHINE ID: NM2C
SOFTWARE VERSION: 1.20
SERIAL NUMBER: 00011066
SYSTEM FEATURES: 0003
PROTOCOL BAUD PARITY STOP DATA
PT A VITALINK 9600 NONE 1 8
PT B OR/LINK 9600 EVEN 2 8
F10 PREVIOUS MENU

SV50102

Figure 7-4: SERIAL PORT CONFIGURATION SCREEN

-- Move the flashing cursor in the PROTOCOL column to the line corresponding to the port for which you want to change the settings.

Press ENTER, then use the up or down arrow key to make the selection, and press ENTER again. The cursor will start flashing.

-- Move the flashing cursor to the BAUD column and press ENTER. Use the up or down arrow key to select the desired baud rate, and press ENTER again. The cursor will start flashing.

-- Move the flashing cursor to the PARITY column and press ENTER. Use the up or down arrow key to select the desired parity, and press ENTER again. The cursor will start flashing.

-- Move the flashing cursor to the STOP column and press ENTER. Use the up or down arrow key to select the desired stop bit, and press ENTER again. The cursor will start flashing.

-- Move the flashing cursor to the DATA column and press ENTER. Use the up or down arrow key to select the desired data bits, and press ENTER again. The cursor will start flashing.

-- On the ORDM keyboard, press ESC to return to the SST Main Menu. (Use F10 on the external PC.)

7.6.2 Set Time and Date

The Set Time and Date screen shown in Figure 7-5 allows verification and setting of the machine's clock.

-- At the SST Main Menu, move the cursor to SET TIME AND DATE and press ENTER.

-- Follow the on-screen instructions for setting the month, day, year, hour and minute.

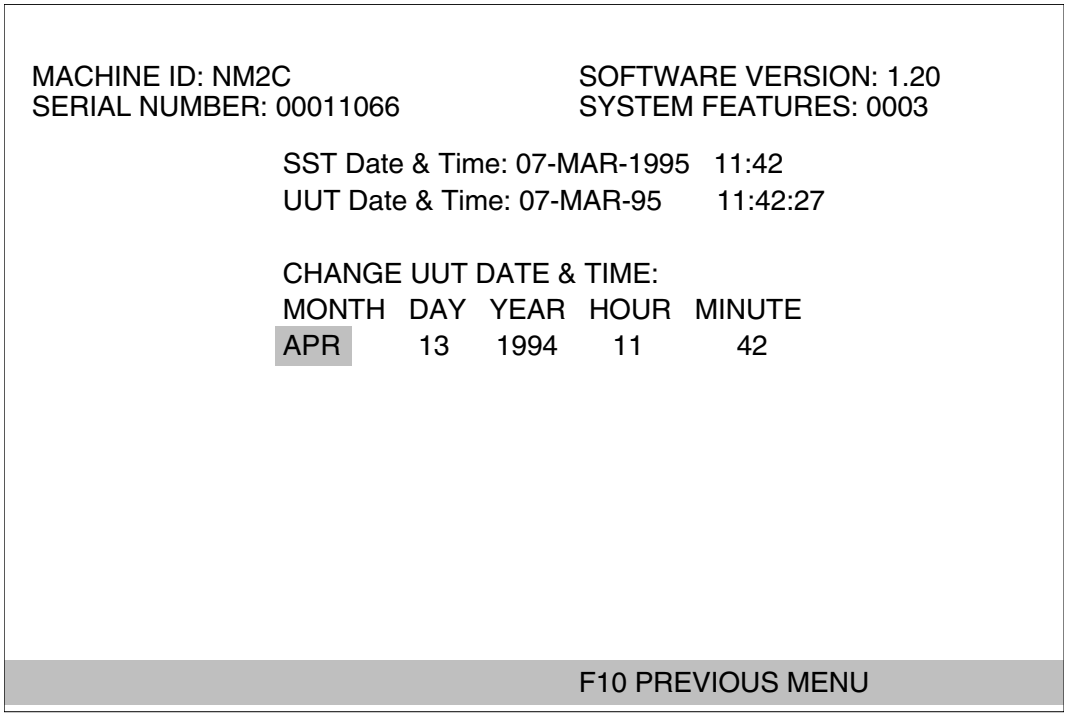


Figure 7-5: SET TIME AND DATE SCREEN

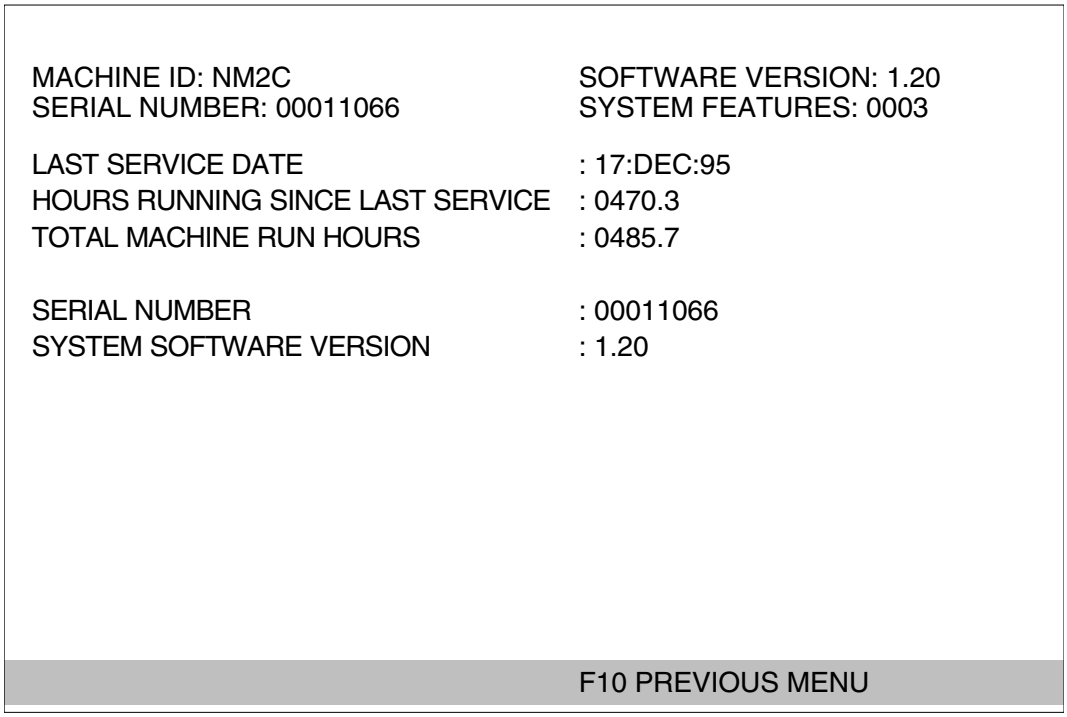
-- On the ORDM, press ESC to return to the SST Main Menu. (Use F10 on the external PC.)

7.6.3 Display UUT Configuration

-- The Display Unit Under Test (UUT) Configuration screen (Figure 7-6) shows the last service date, machine hours, and the software version number for each of the machine items listed.

-- At the SST Main Menu, move the cursor to DISPLAY UUT CONFIGURATION and press ENTER.

-- On the ORDM, press ESC to return to the SST Main Menu. (Use F10 on the external PC.)


MACHINE ID: NM2C
SOFTWARE VERSION: 1.20
SERIAL NUMBER: 00011066
SYSTEM FEATURES: 0003
LAST SERVICE DATE : 17:DEC:95
HOURS RUNNING SINCE LAST SERVICE : 0470.3
TOTAL MACHINE RUN HOURS : 0485.7
SERIAL NUMBER : 00011066
SYSTEM SOFTWARE VERSION : 1.20
F10 PREVIOUS MENU

SV50104

Figure 7-6: DISPLAY UUT CONFIGURATION SCREEN

7.6.4 Save/Restore Settings

This screen allows serial port configuration and templates to be copied to the ORDM disk drive, or to the external PC disk drive. These settings can then be restored from the disk to the machine following any hardware replacement.

-- At the Primary Service Menu (described earlier) set the cursor to SAVE/RESTORE SETTINGS and press ENTER.

-- Move the cursor with the up or down keys to the desired function and press ENTER.

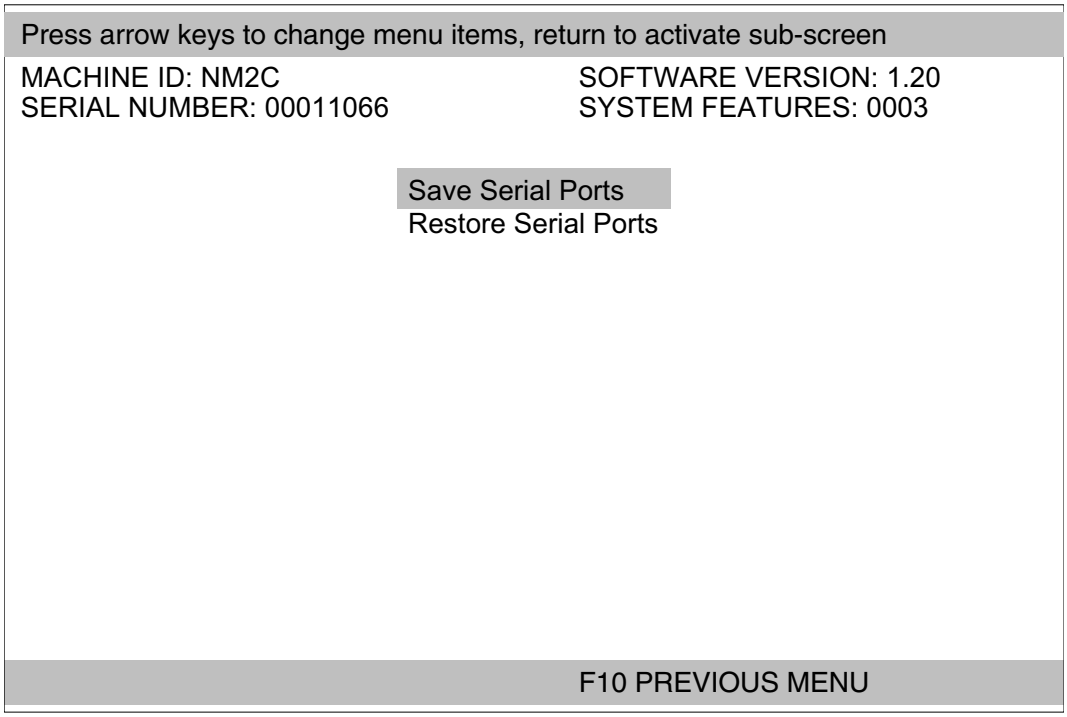


Figure 7-7: SAVE/RESTORE SETTINGS SCREEN

-- Press ESC on the ORDM (F10 on the external PC) to return to the Primary Service Menu. If desired, press ESC (or F10) again to return to the SST Main Menu.

7.6.5 Primary Service Menu

At the SST Main Menu, move the cursor to ENTER PRIMARY SERVICE and press ENTER. Software installation and other service functions are entered through this screen, shown in Figure 7-8.

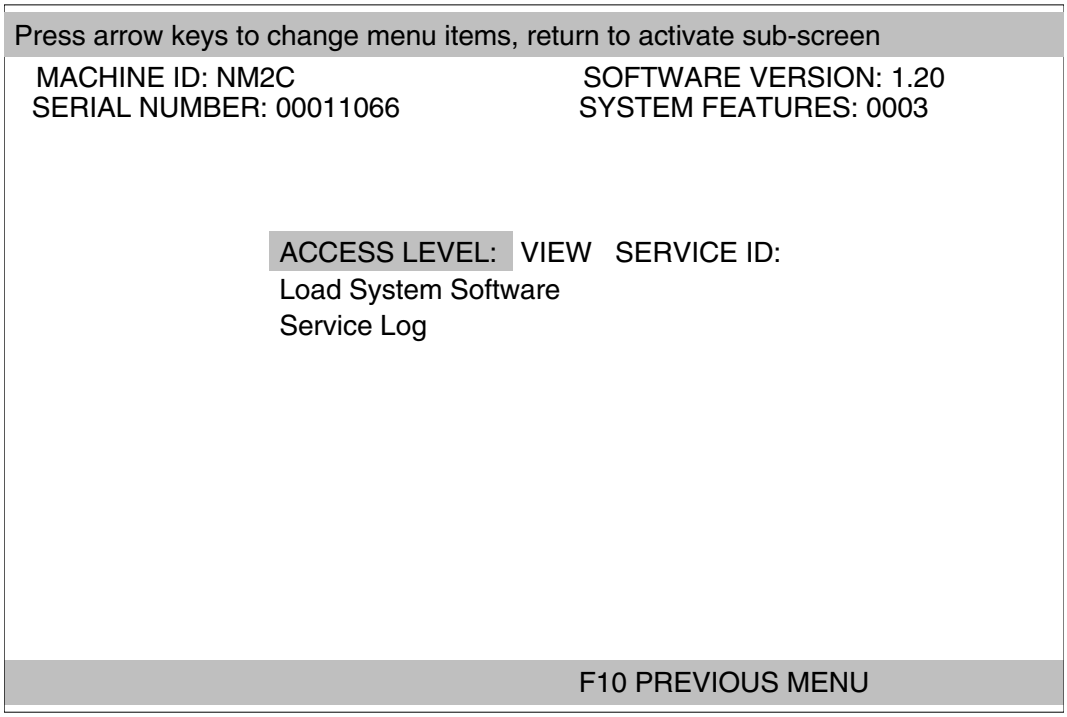


Figure 7-8: PRIMARY SERVICE MENU

-- With the flashing cursor at ACCESS LEVEL, press ENTER.

-- Use the up or down arrow key to select the desired mode and press ENTER. The following service modes are available:

VIEW: For verifying machine configuration and status
SERV: For unscheduled service
PMS: For scheduled Periodic Manufacturer's Service
INST: For initial installation

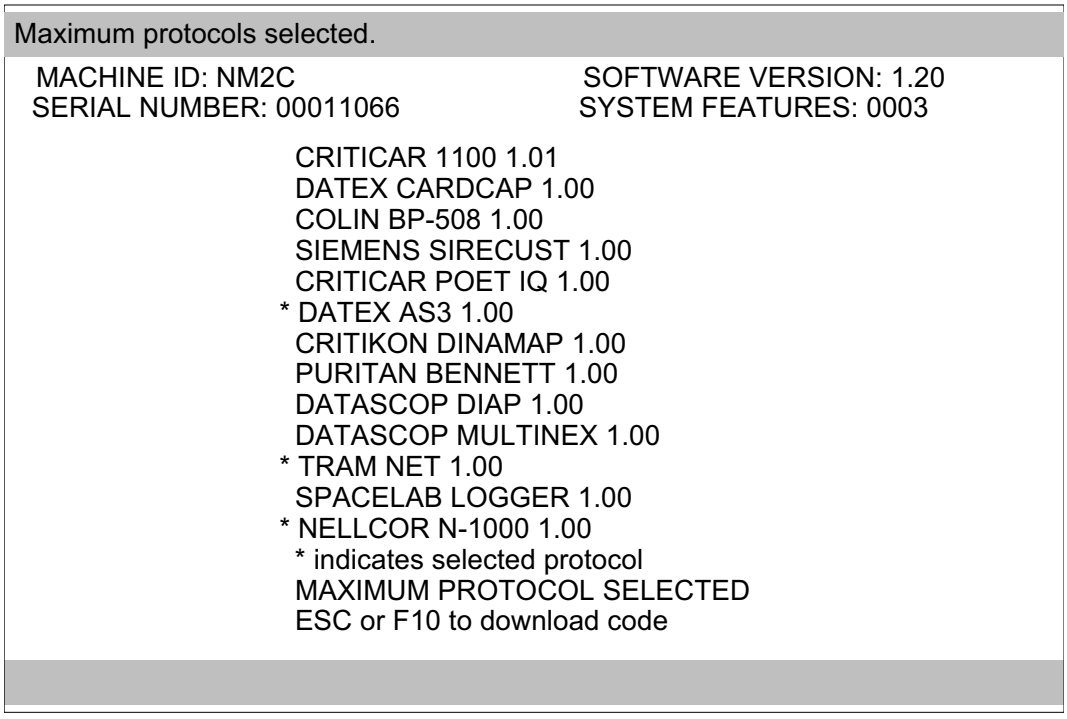
-- Type in your ID on the ORDM or (external PC) keyboard and press ENTER again.

-- Move the cursor with the up or down keys to select the desired functions. These are described in the following paragraphs.

7.6.6 Download System Software

This screen displays the list of protocols available for communication with external monitors.

-- At the Primary Service Menu (described earlier), move the cursor to LOAD SYSTEM SOFTWARE, and press ENTER.



SV50124

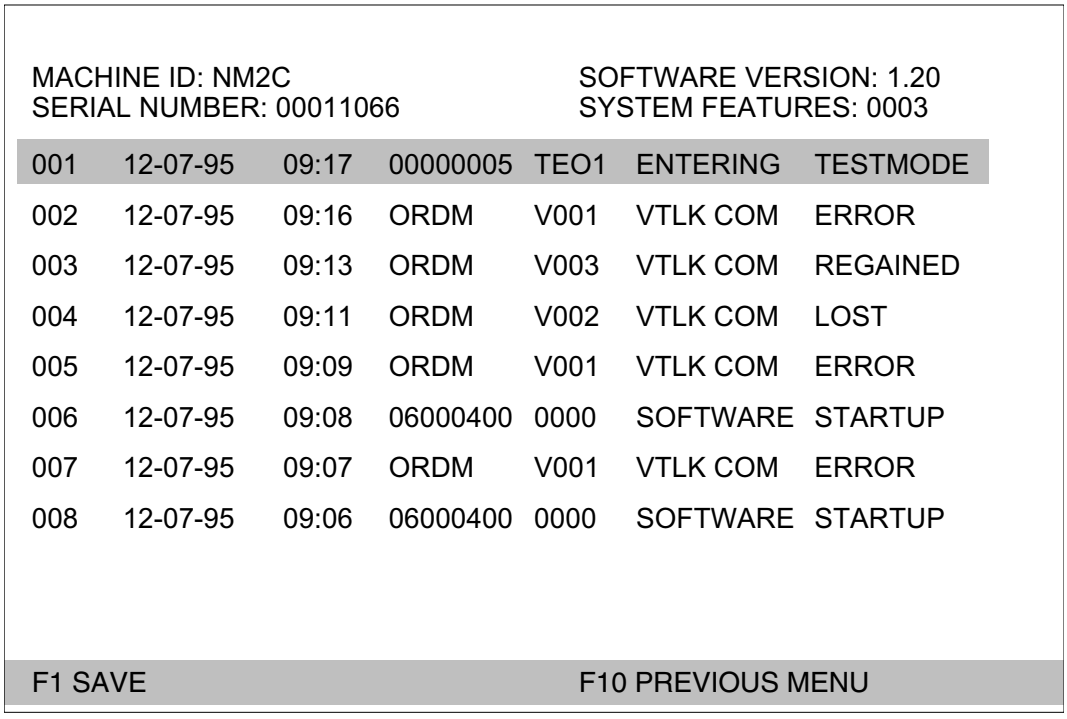
Figure 7-9: SELECT PROTOCOL SCREEN

-- Use the up and down arrow keys to scroll through the list; press ENTER to select the desired protocol(s), and press ESC to initiate the downloading process. (Ref. Paragraphs **7.4** and **7.5**)

7.6.7 Service Log

This screen displays the service log of the machine showing a list of normal and failed events, error events, service and calibration events. See Figure 7-10.

-- At the Primary Service Menu (described earlier) set the cursor at SERVICE LOG and press ENTER.


MACHINE ID: NM2C
SERIAL NUMBER: 00011066
SOFTWARE VERSION: 1.20
SYSTEM FEATURES: 0003
001 12-07-95 09:17 00000005 TEO1 ENTERING TESTMODE
002 12-07-95 09:16 ORDM V001 VTLK COM ERROR
003 12-07-95 09:13 ORDM V003 VTLK COM REGAINED
004 12-07-95 09:11 ORDM V002 VTLK COM LOST
005 12-07-95 09:09 ORDM V001 VTLK COM ERROR
006 12-07-95 09:08 06000400 0000 SOFTWARE STARTUP
007 12-07-95 09:07 ORDM V001 VTLK COM ERROR
008 12-07-95 09:06 06000400 0000 SOFTWARE STARTUP
F1 SAVE
F10 PREVIOUS MENU

SV50106

Figure 7-10: SERVICE LOG SCREEN

-- Use the up and down arrow keys to scroll through the log; PGUP and PGDN keys to move from page to page in the log.

-- To copy the service log to the disk drive in the ORDM or the external PC, press the F1 (save) key.

-- To clear the service log, press the DRUGS key on the ORDM (F3 on the external PC). (This function is not available in the VIEW mode.)

-- Press ESC on the ORDM (F10 on the external PC) to return to the Primary Service Menu. If desired, press ESC (or F10) again to return to the SST Main Menu.

7.6.8 Secondary Service Screen

This screen allows access to the functions shown in Figure 7-11.

WARNING: These functions should only be accessed by a Draeger Medical, Inc. qualified Technical Service Representative. Improper access to certain functions may cause important service data to be lost.

-- At the Primary Service Menu (described earlier) select the SERV access level and enter your ID.

-- Press ALT H on the ORDM keyboard, then type in **2 5 6** to display the secondary service screen.

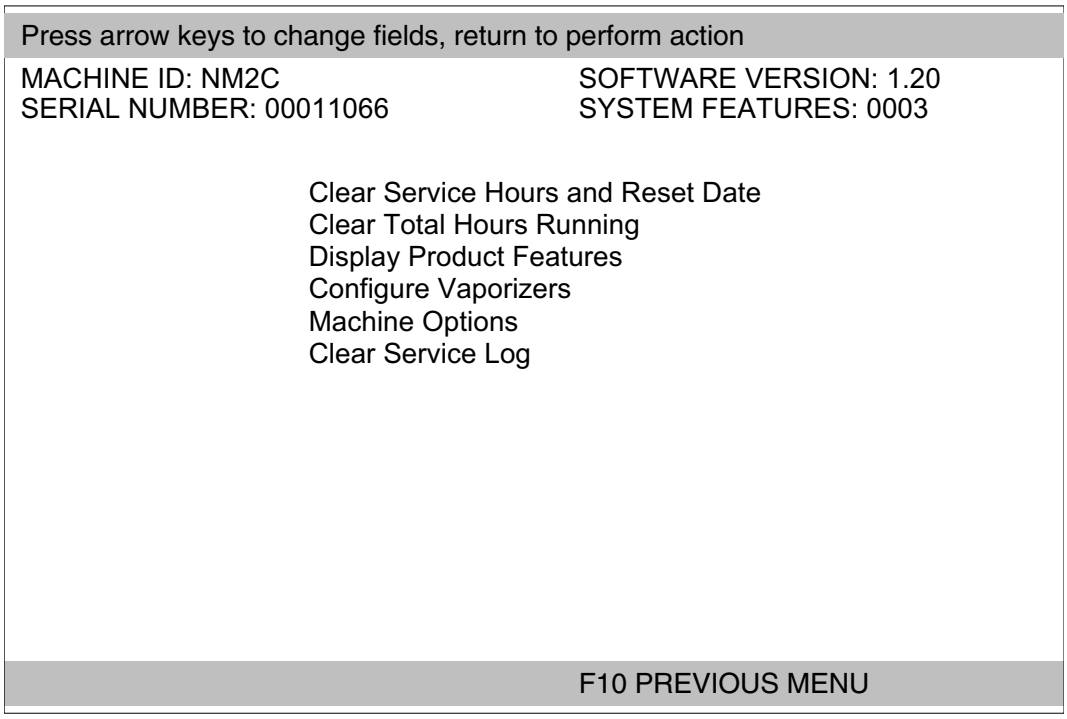


Figure 7-11: SECONDARY SERVICE SCREEN

-- Press ESC on the ORDM (F10 on the external PC) to return to the Primary Service Menu. If desired, press ESC (or F10) again to return to the SST Main Menu.

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8.0 SPARE AND REPLACEMENT PARTS

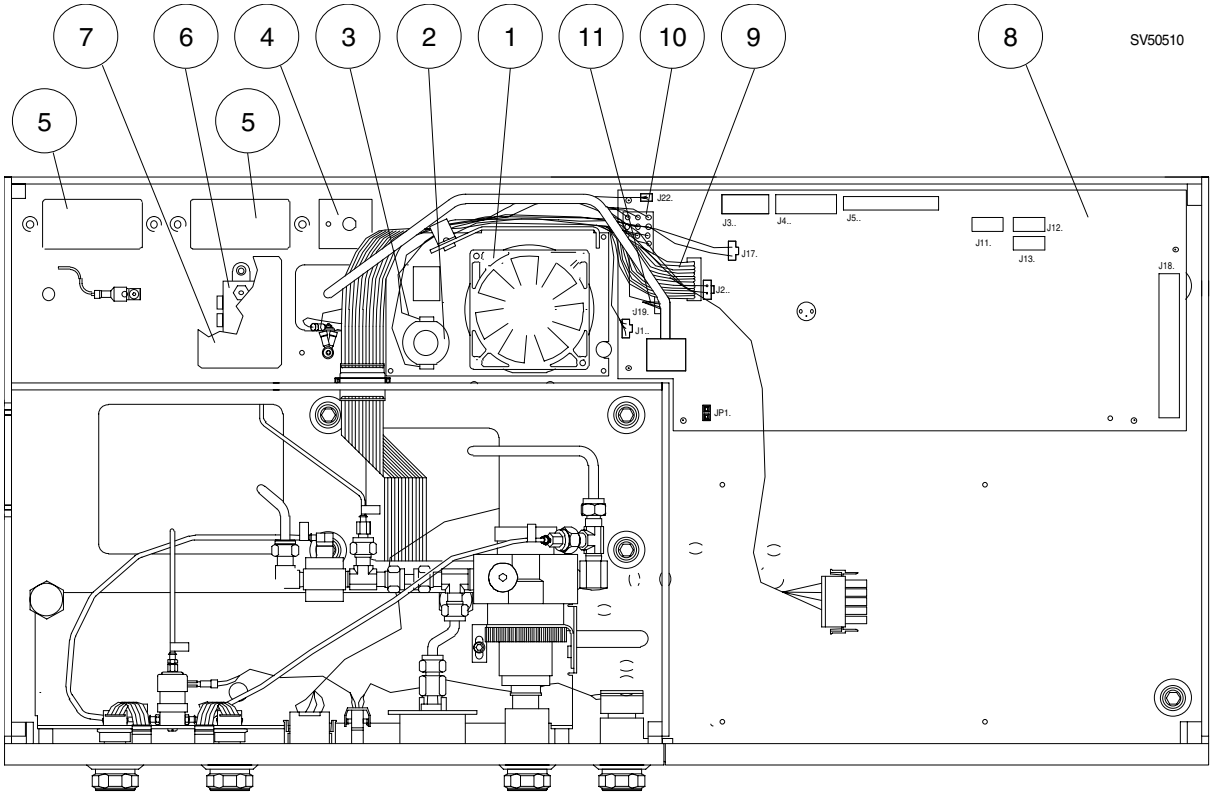
Part numbers for field-replaceable items on the NARKOMED 2C anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

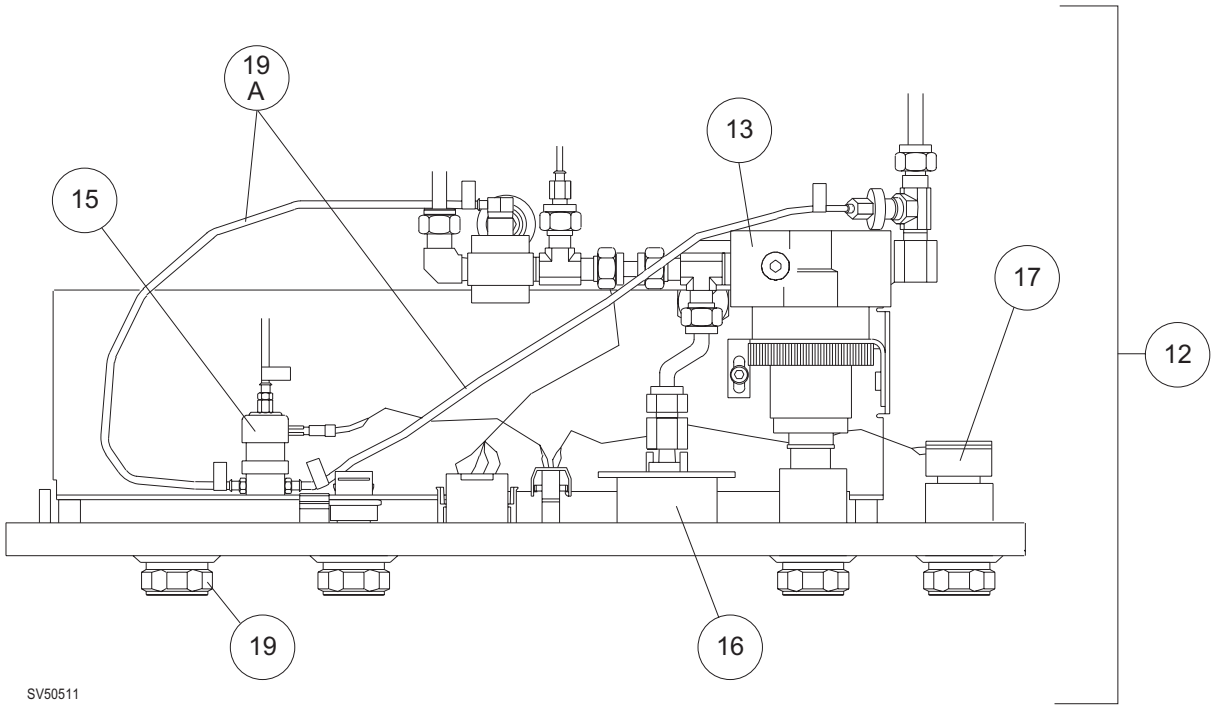
ASSEMBLY/PART PAGE

Processor Asm. and related cables, Fan, Convenience Outlets and related items . 8-2, 8-3
AV-2 Ventilator Controller Assembly 8-4, 8-5
Valve Case and Guide Assembly, Pressure Limit Control, Bellows Assembly. . . . 8-6, 8-7
Bellows Valve Assembly details 8-7A, 8-7B
Display Arm, Datagrip and Display Assemblies 8-8, 8-9
Pipeline Inlet Fittings 8-10, 8-11
Failsafe Assemblies, Minimum O_2 Flow Valve Assembly 8-12, 8-13
Vapor Indicator PCB, Vapor Select Switches, Gas Selector Switch and Valves . . 8-14, 8-15
Vapor Exclusion System 8-15A, 8-15B
ORC Assembly 8-16, 8-17
Alarm Channel Assembly and related cables 8-18, 8-19
Flowmeter Shields, Knobs, Labels, Gauges 8-20, 8-21
Flow Tubes, Restrictor Assemblies, Flow Control Valve 8-22, 8-23
Cyl. Regulator Assemblies, O_2 Flush Valve and related parts 8-24, 8-25
CSA Items: Relief Valve, Cylinder Cutoff Valves 8-26, 8-27
Canada Fresh Gas Outlet 8-27A, 8-27B
Yokes, Common Parts, Labels 8-28, 8-29
Sensor Interface Panel Asms., AC Power, Battery, Power Supply, Casters 8-30, 8-31
O.R. Data Manager, Incl. Keyboard 8-32, 8-33
Absorber Assembly, Breathing Pressure Hoses, Oxygen Sensor 8-34, 8-35
Ultrasonic Flow Sensor Assembly 8-35A, 8-35B
Man/Auto Selector Valve 8-36, 8-37
Man/Auto Selector Valve (later design) 8-38, 8-39
Auxiliary O_2 Flowmeter Assembly 8-40, 8-41
Open Reservoir Scavenger 8-42, 8-43
Open Reservoir Scavenger, old style 8-44, 8-45
A/C Scavenger & Vent Grill Adapter 8-46, 8-47

SPARE AND REPLACEMENT PARTS (continued) NM2C



ITEM	DESCRIPTION	PART NUMBER
1	Fan Assembly (Incl. Wire Harness)	4111732
2	Speaker	4106335
3	Speaker Wire Harness	4112169
4	Circuit Breaker	4110537-008
5	AC Receptacle	4106086
	AC Receptacle, later design (not interchangeable)	4112574-001
6	Filter (Convenience Outlets)	4112450
7	Cover, AC Power Filter	4109622
	Later replaced by	4112822
8	Processor Assembly (earlier models)	4112211
	Service Exchange	SE4112211
	Processor Assembly (later models w/additional memory)	4112701
9	Cable Asm, Ventilator Box to Processor J16	4111997-001
10	Wire Harness, Power Supply J3 to Processor J15	4112007
11	Cable Asm, Vapor Indicator J1 PCB to Processor J19	4111236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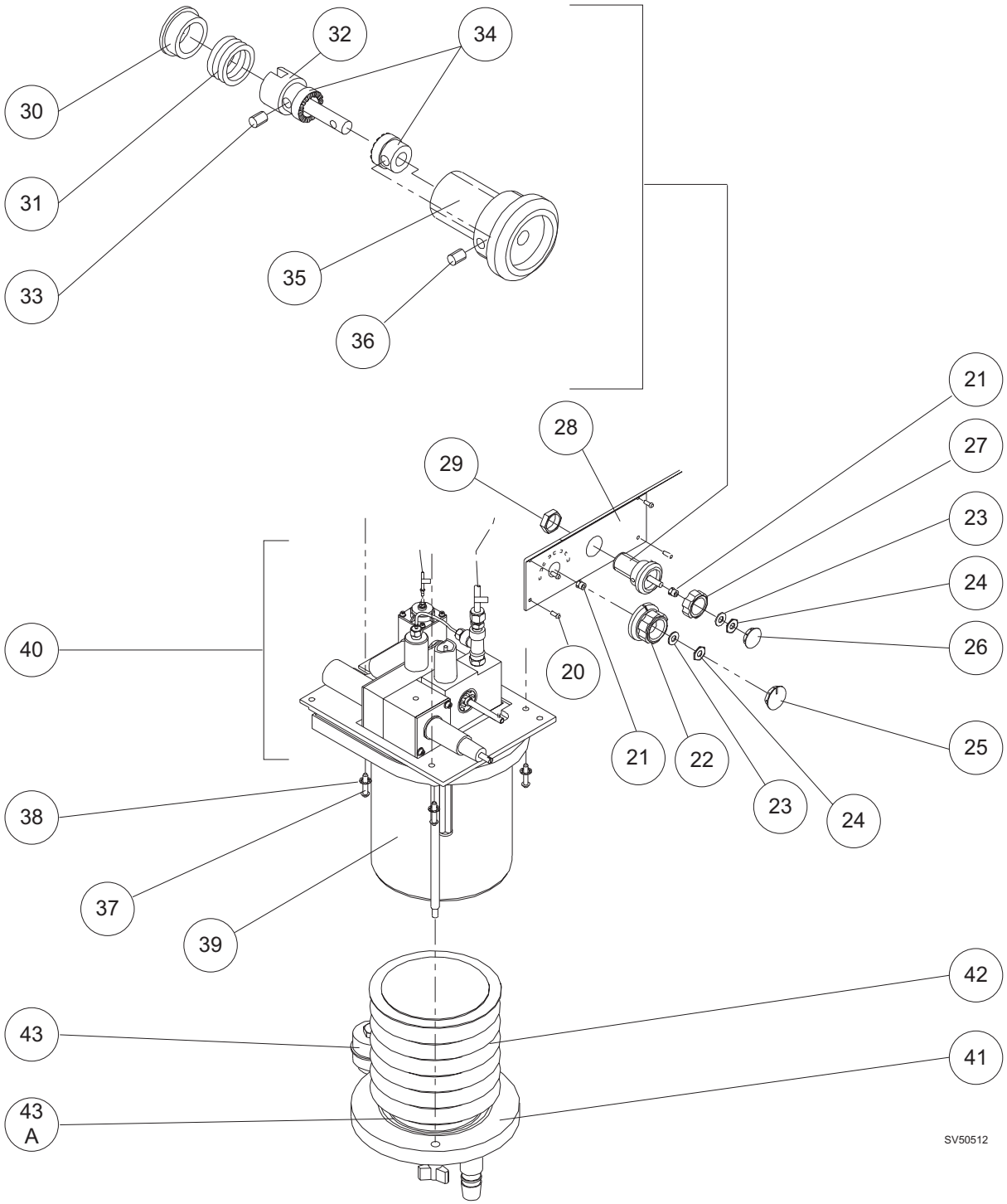
SV50511

ITEM	DESCRIPTION	PART NUMBER
AV-2		
12	AV-2 Ventilator Controller Assembly (Bezel Assembly)	4112273-001
	Service Exchange part number is	SE4112273-S01
13	Inspiratory Flow Regulator	4102045
14	Deleted	
15	Solenoid	4110906
16	Gauge	4112251-001
17	On-Off Switch & Wire Harness (Incl. Solenoid Wire Harness)	4112253
18	Deleted	
19	Knob (4x)	4112157
	(new part number)	4113281
	Knob Cover (3x) (all except ON-OFF switch)	4112245-003
	(new part number)	4113278-002
	Knob Cover (ON-OFF switch)	4112245-002
	(new part number)	4113278-001
19A	1/8 in. Tygon tubing	ML08003
AV-2+		
12	AV-2+ Ventilator Controller Assembly (Bezel Assembly)	4113132-001
	Service Exchange	SE4113132-001
13	Inspiratory Flow Regulator	4114252
	Regulator rebuild kit	4115151
14	Deleted	
15	Solenoid	4110906
16	Gauge	4112251-001
	Solenoid Wire Harness	4113137
17	On-off switch & wire harness	4113136
18	Deleted	
19	Knob (4x)	4113281
	Knob Cover (3x) (all except ON-OFF switch)	4113278-002
	Knob Cover (ON-OFF switch)	4113278-001
19A	1/8 in. Tygon tubing	ML08003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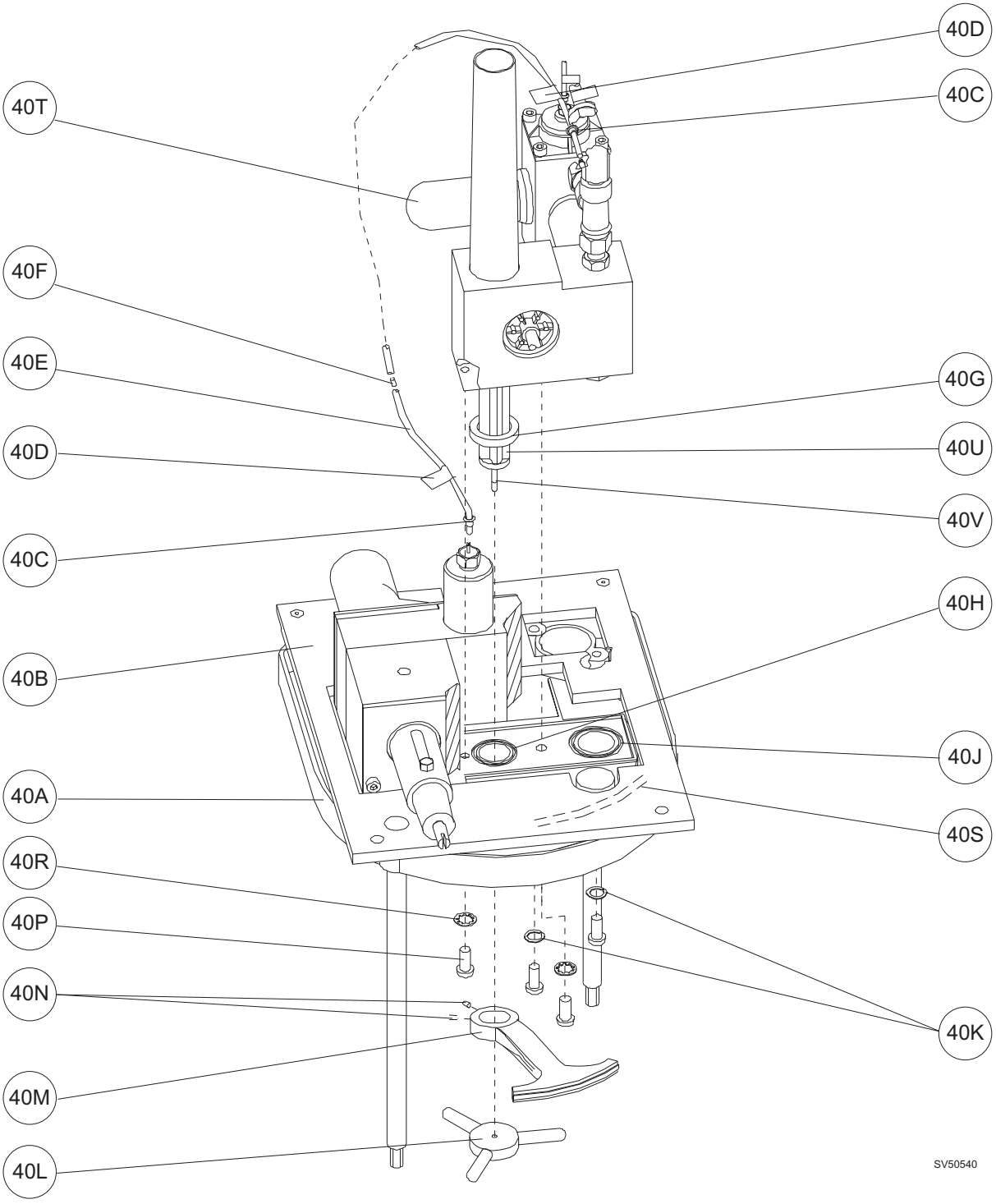
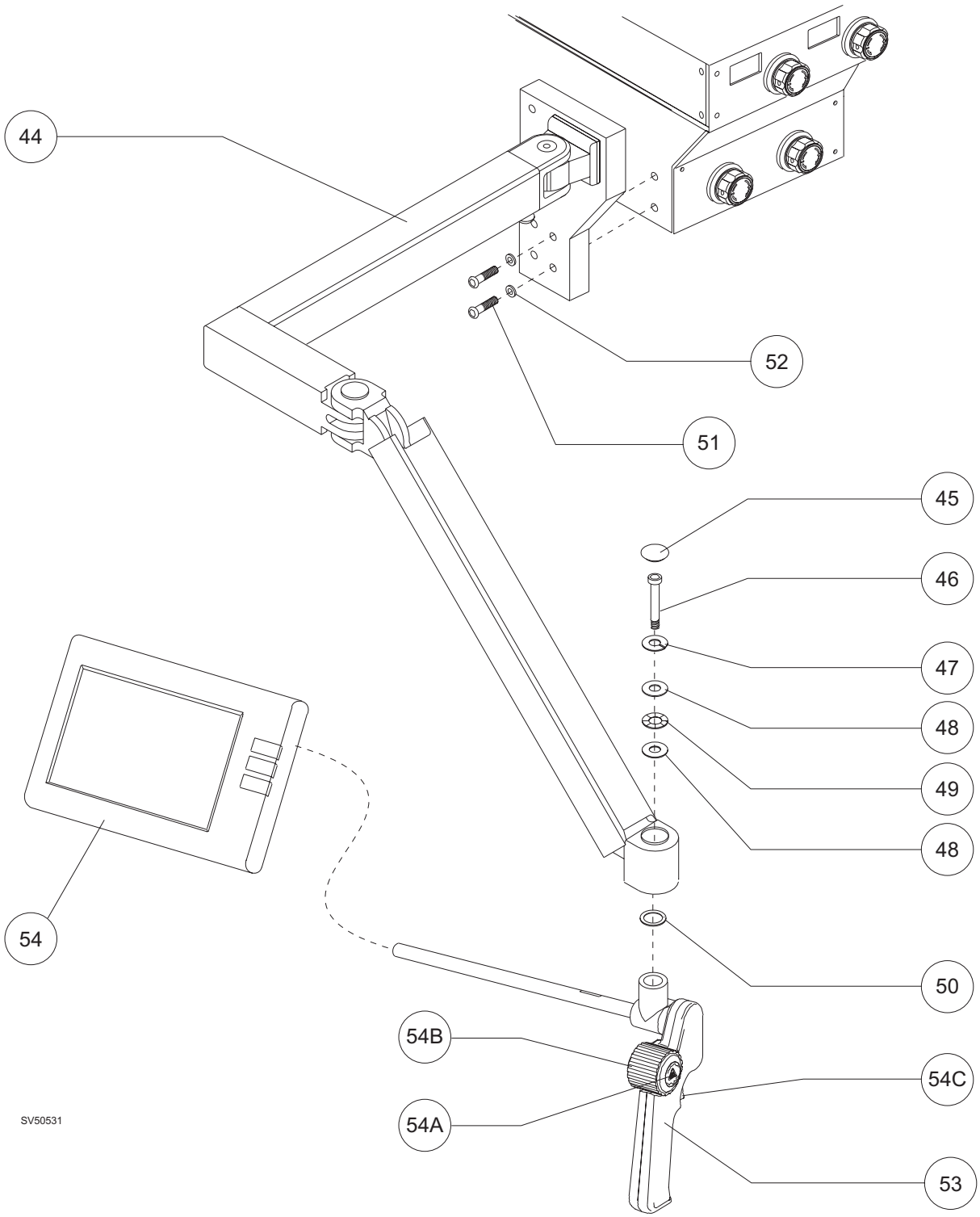
SV50512

ITEM	DESCRIPTION	PART NUMBER
20	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
21	Collet	4112167
22	Knob, PLC Adj.	4112502
	(new part number)	4113279
23	Flat Washer, #10	HW66003
24	Hex Nut, M5 x 0.5	4112066
25	Knob Cover	4112245-002
	(new part number)	4113278-002
26	Knob Cover	4113278-002
27	Knob	4112152
	(new part number)	4113280
28	Front Plate, Bellows Box	4112230
29	Panel Nut	4107460
30	Spring Retainer	4107546
31	Spring	4110975
32	Shaft	4112175
33	Set Screw, 6-32 x 3/16 in.	HW07002
34	Clutch	4107544
35	Housing	4112467
36	Set Screw, 6-32 x ¼ in.	HW04003
37	Screw, ¼-20 x 1 in. Btn Hd Skt (3x)	HW09057
38	Lock Washer, ¼ int-t (3x)	HW67017
39	Canister	4106948
	O-ring, bellows canister	4107018
40	Bellows Valve Assembly (Parts Breakdown listed on a subsequent page)	4112272
	Service Exchange	SE4112272-S01
41	Bellows Assembly, Adult	4106935
	Service Exchange	SE4106935
42	Deleted	
	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
	O-ring #217 (neoprene)	4101817
43	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
43A	Gasket, bottom	4105849

SPARE AND REPLACEMENT PARTS (continued) **NM2C**



ITEM	DESCRIPTION	PART NUMBER
40 (Ref)	Bellows Valve Assembly	4112272
	Service Exchange	SE4112272-S01
40A	Bellows Top Plate	4111872
40B	Adapter Plate	4111979
40C	Press-on Hose Clamp (2x)	4104161
40D	Label, O_2 Tubing (2x)	4109871
40E	Hose, 0.075 I.D.	ML08003
40F	Restrictor	4107639
40G	Guide Ring	1101294
40H	O-ring #019 (Silicone)	4107096
40J	O-ring #022 (Neoprene)	4104595
40K	Lockwasher, #8 Split (2x)	HW65011
40L	Bellows Top Guide	4110735
40M	Volume Indicator	4108276
40N	Set Screw, 6-32 x ¼ in. cup point (2x)	HW04003
40P	Screw, 8-32 x ⅜ in. btn hd skt (4x)	HW09008
40R	Lock Washer, #8 int-t (2x)	HW67000
40S	O-ring #256 (Neoprene)	4107018
40T	Silencer	4110999
40U	Bellows adjustment rod	4110727
40V	Rod	4106918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54B
54C
54A
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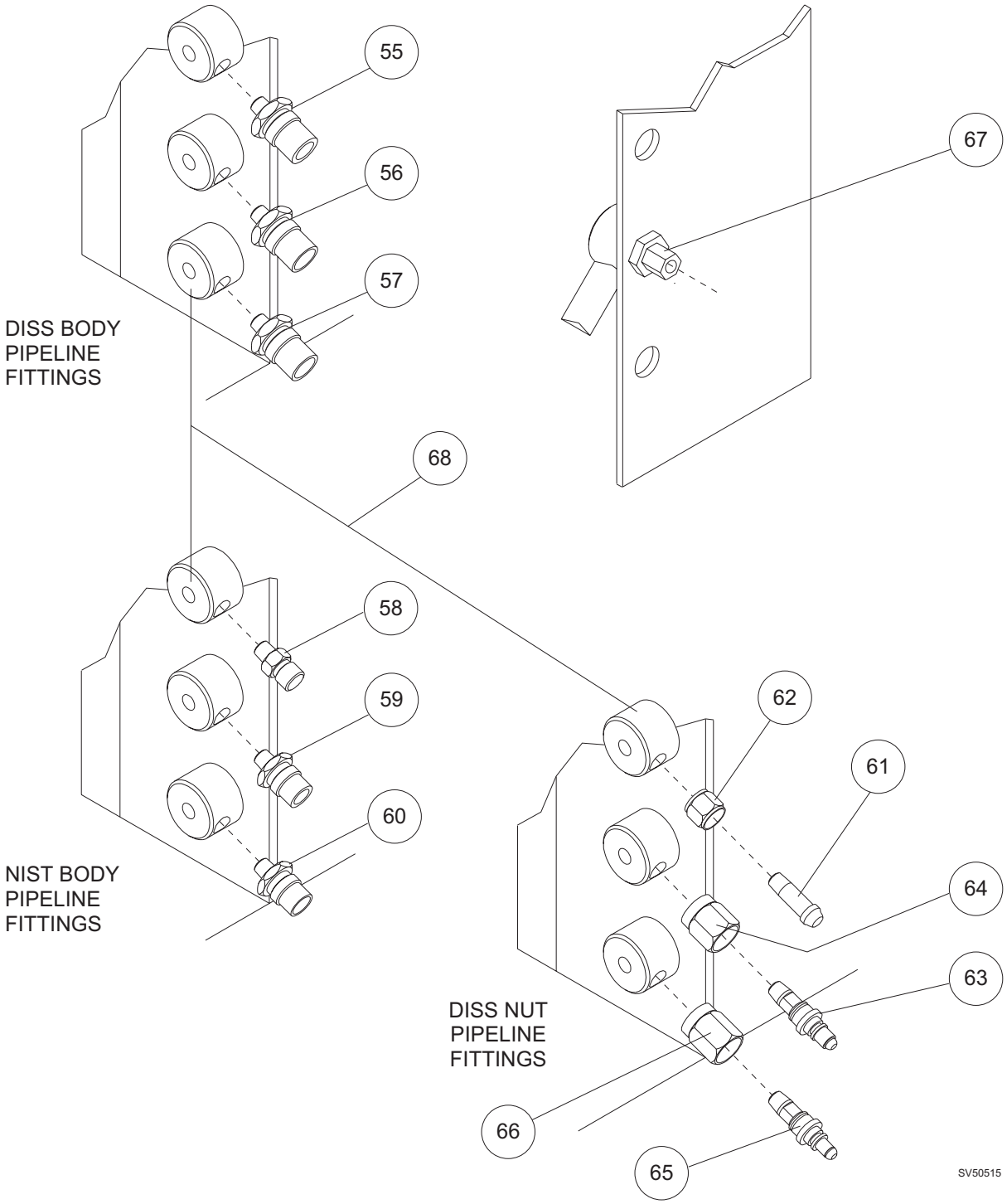
SV50531

ITEM	DESCRIPTION	PART NUMBER
44	Display Arm Assembly	4112524
	Later Replaced by	4112591-001
45	Cap, Plastic	4111184
46	Mounting Screw	4111199-004
47	Lockwasher	HW65010
48	Spacer (2x)	4110792-045
49	Bearing	4111181
50	Spacer, Delrin	4110792-044
	Cable Clamp, ⅜ in. (3x)	4112300
	Screw, Cable Clamp, 6-32 x ⅜ (3x)	HW09000
51	Screw, ¼-20 x ⅞ in. Btn Hd Skt (6x)	HW09063
	[If the machine is equipped with an optional manual sphygmomanometer, the lower front corner mounting screw is a ¼-20 x 2 in. P/N HW09064]	
52	Lock Washer, ¼ split (6x)	HW65010
53	Datagrip Assembly	4111907
	Service Exchange	SE4111907
54	Display Assembly	4112314
	Service Exchange	SE4112314
54A	Label, Dot, "Datagrip"	4111882
54B	Knob, Datagrip	4111782
	Set screw, 6-32 x 1/2 in. cup pt	HW04032
	O-ring, #021 (Neoprene)	4104576
	Cable assembly, Datagrip	4112779-001
	Screw, 4-40 x 5/16 in. btn hd skt (3x)	HW09014
	Screw, 4-40 x 1/2 in. btn hd skt (2x)	HW09028
54C	Trigger	4111780
	Spring, CPRSN, 0.120 OD x 3/4 L	4110975-020


55
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DISS BODY
PIPELINE
FITTINGS
67
68
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NIST BODY
PIPELINE
FITTINGS
62
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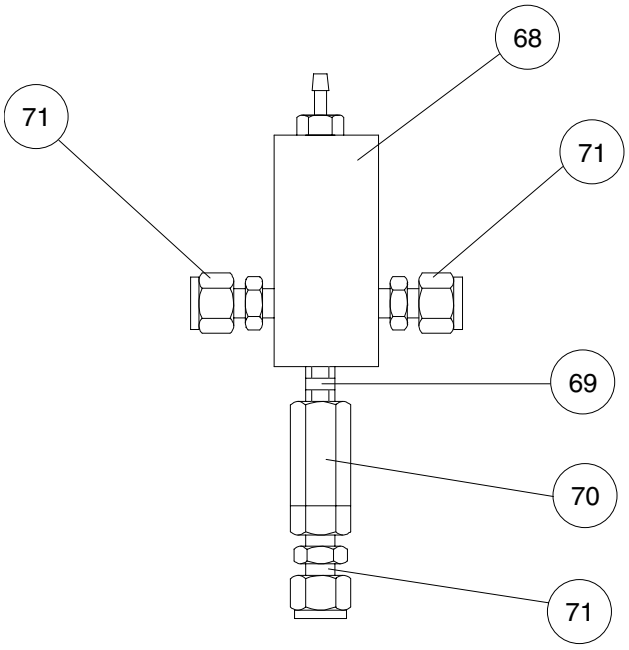
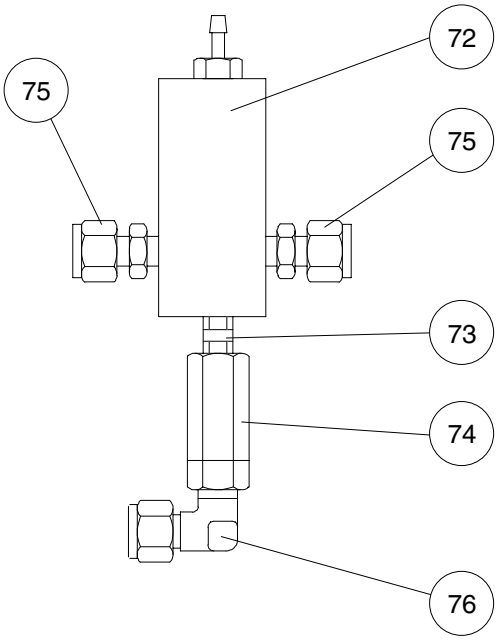
64
63
DISS NUT
PIPELINE
FITTINGS
66
65
SV50515

ITEM	DESCRIPTION	PART NUMBER
	DISS Body Pipeline Fittings:	
55	O_2 DISS Fitting	4102563
56	Air DISS Fitting	4102886
57	N_2O DISS Fitting	4111384
	NIST Body Pipeline Fittings:	
58	O_2 Male NIST Connector	4110388
59	Air Male NIST Connector	4110386
60	N_2O Male NIST Connector	4111382
	DISS Nut Pipeline Fittings:	
61	O_2 DISS Nipple	4103877
62	O_2 DISS Nut	4102848
63	Air DISS Nipple	4111385
64	Air DISS Nut	4103120
65	N_2O DISS Nipple	4111383
66	N_2O DISS Nut	4102850
67	Pipeline Inlet Filter Asm (Typ., All Inlets)	4106198
	Filter	4102532
	Connector	4106897
	O-ring for N_2O DISS Nipple	4113494
	Common Parts:	
67A	Pipeline Inlet Housing (old No.)	4102559
	(replaced by)	4113363
	(new no.)	4113974
	Nut, 5/8-18	HW52002
	Lock Washer, 5/8 int-t	HW67001

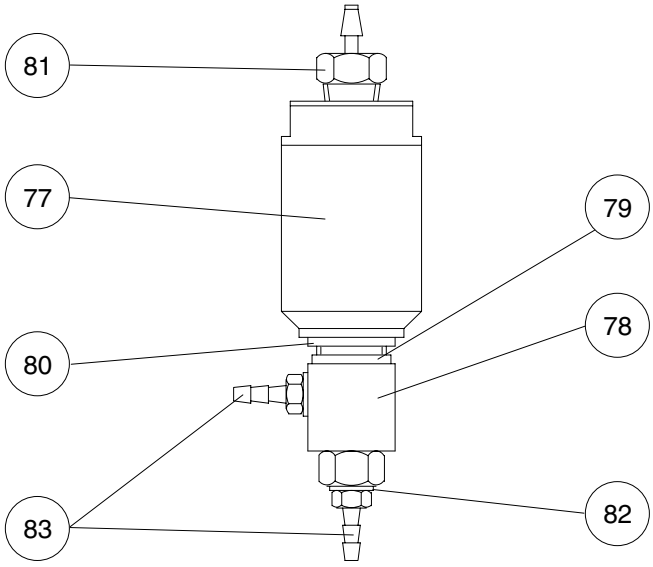
N2O FAILSAFE ASSEMBLY



AIR OR THIRD GAS FAILSAFE ASSEMBLY

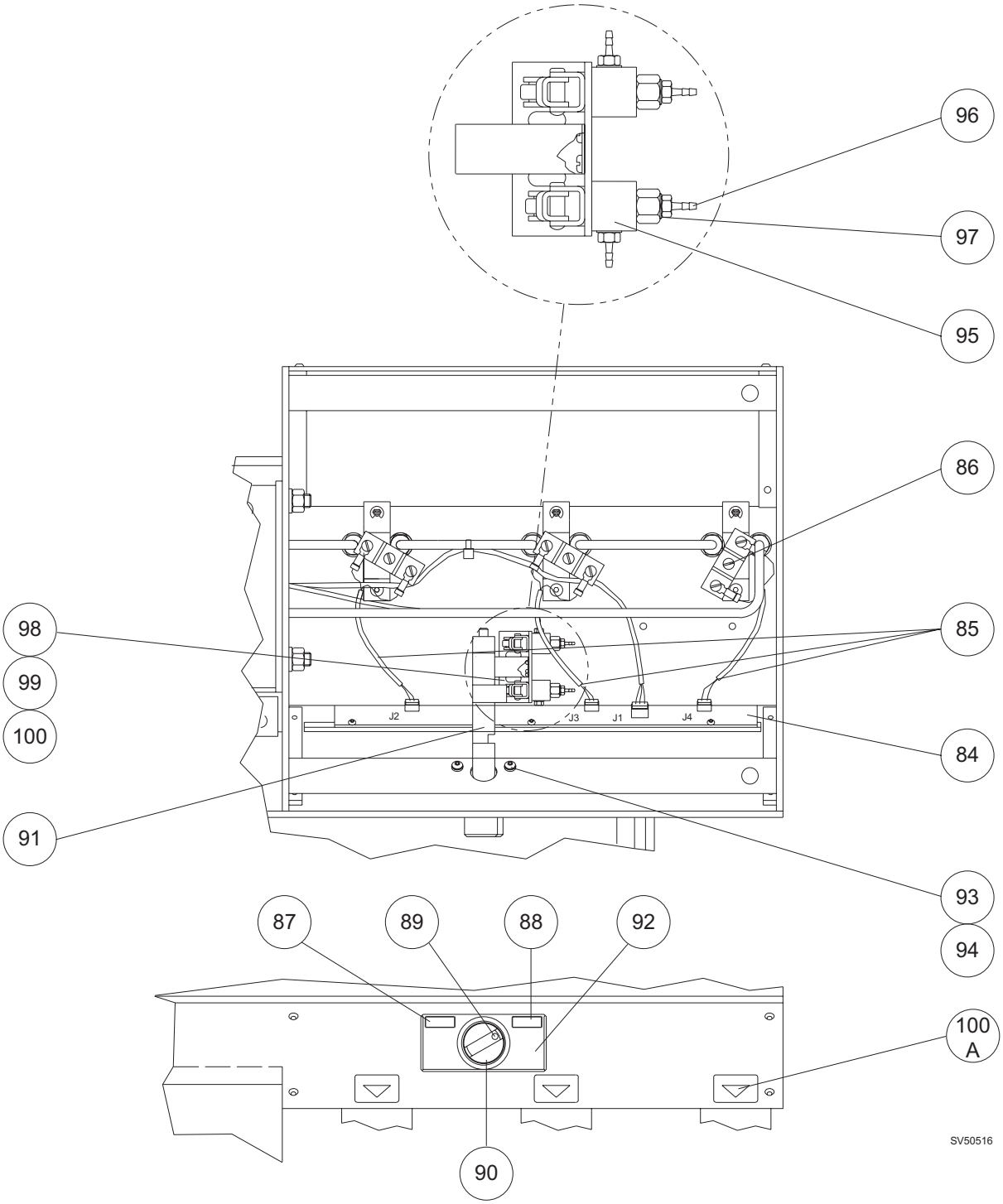


MINIMUM FLOW O2 VALVE ASSEMBLY



SV50513

ITEM	DESCRIPTION	PART NUMBER
	N_2O Failsafe Assembly:	
68	Failsafe Block Asembly	4112043
69	Nipple, ⅛ NPT x ¾ in.	4102784
70	Check Valve, MJCV-1	4105815
71	Straight Fitting, ¼Tube x ⅛ MPT (3x)	4109408
	Air or 3rd Gas Failsafe Assembly:	
72	Failsafe Block Asembly	4112043
73	Nipple, ⅛ NPT x ¾ in.	4102784
74	Check Valve, MJCV-1	4105815
75	Straight Fitting, ¼Tube x ⅛ MPT (2x)	4109408
76	Elbow Fitting, ¼Tube x ⅛ MPT	4109410
	Minimum O_2 Flow Valve Assembly:	
77	Pilot Actuator	4102055
78	Valve, 2-Way Poppet	4103549
79	Lock Washer	(Supplied with Valve)
80	Spacer	4110792-013
81	Fitting, nylon 1/16 I.D. Hose x ⅛ MPT	4106366
	Replaced by brass fitting (requires press-on hose clamp 4104161 instead of tie strap)	4111771
82	Washer (2x)	4102165
83	Fitting, 1/16 I.D. Hose x 10-32 (2x)	4103445
	Later design fitting has integral seal (replaces previous two items)	4112707
	Tie Strap, 0.131W x 8.04L (2x)	1101732


96
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100
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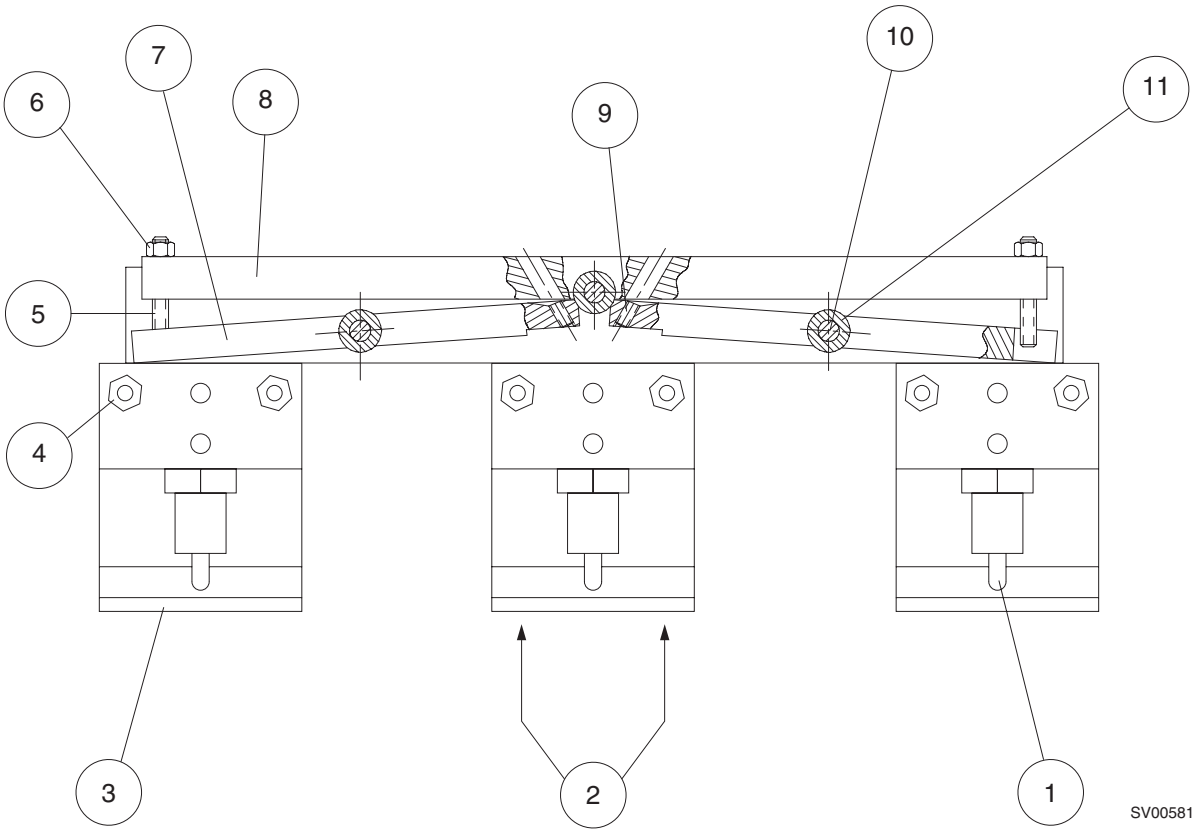
J2
J3
J1
J4
SV50516

ITEM	DESCRIPTION	PART NUMBER
84	Vapor Indicator PCB	4110219
85	Wire Harness, Vapor Select Switch (3x)	4110233
86	Switch, Vapor Select (3x)	4111718
	Gas Selector Switch Assembly:	
87	Label, O_2 + N_2O	4108461
88	Label, ALL GASES	4108462
89	Label, Dot	4103423
90	Knob	4103169
	Set screw, locking, 8-32 x 3/8 in. cup pt.	HW10004
	(Later style knobs use non-locking set screw)	HW04025
91	Camshaft, Gas Selector	4109867
92	Block, Gas Selector Switch	4109866
93	Switch Asm Mounting Screws, 8-32 x 3/8 in. skt hd (2x)	HW01012
94	Lock Washer, #8 int-t (2x)	HW67000
	Valve Assembly, Gas Selector:	
95	Valve, Gas Selector (2x)	4103621
96	Fitting, 1/16 I.D. Hose x 10-32 (4x)	4103445
97	Washer (4x)	4102165
	Later design fitting has integral seal (replaces previous two items)	4112707
98	Valve Asm Mounting Screws, 10-32 x 5/16 in. skt hd (2x)	HW01022
99	Lock Washer, #10 int-t (2x)	HW67006
100	Flat Washer, #10 (2x)	HW66003
100A	Label, Arrow Vaporizer	4112055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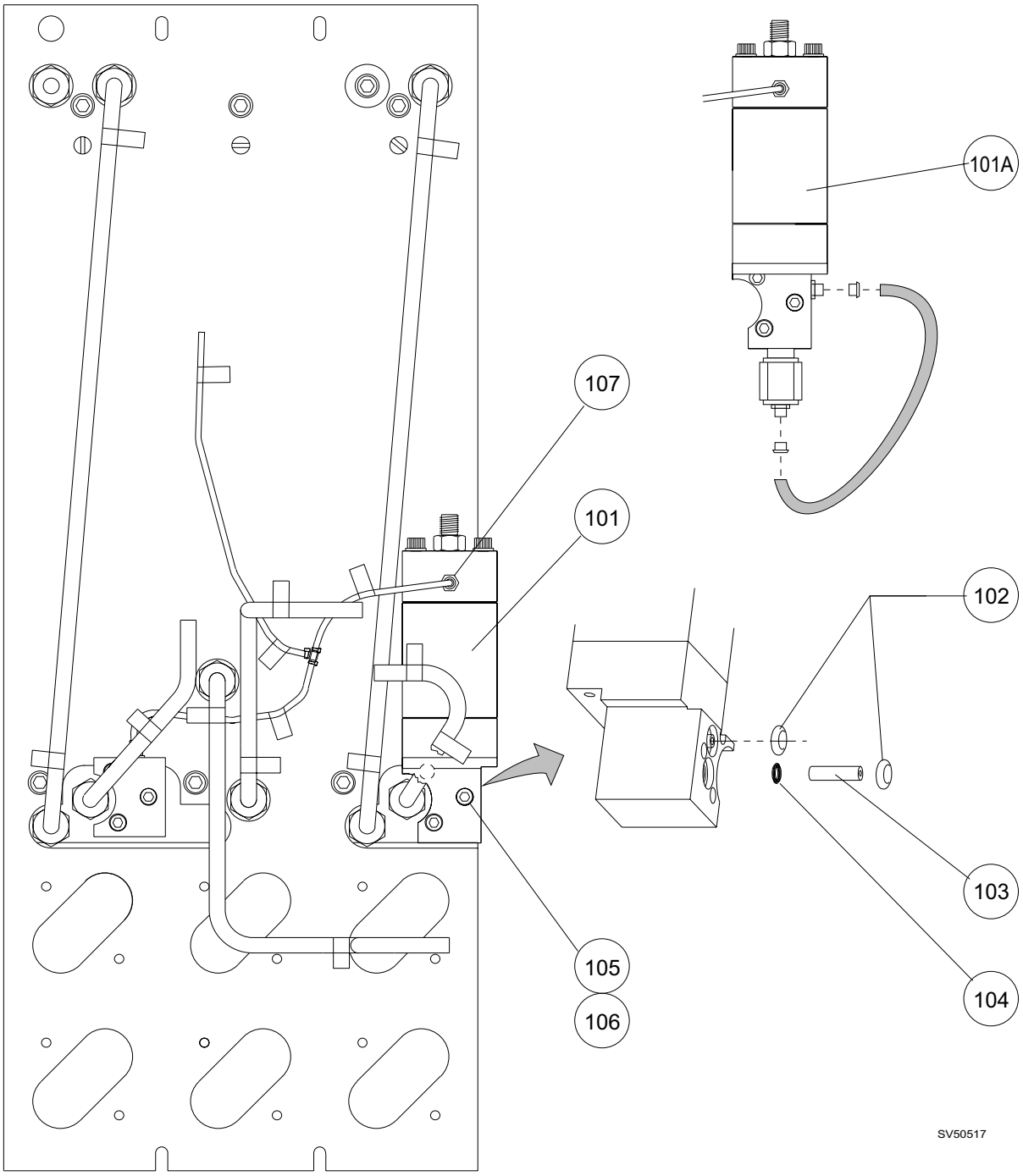
SV00581

ITEM	DESCRIPTION	PART NUMBER
1	Pin assembly	4110187
2	O-rings (2x per vaporizer)	2121929
3	Cover assembly, vapor block (plastic)	4112699
4	Straight fitting, 1/4 tube	4109408
5	Set screw, 10-32 (2x)	HW04012
6	Kep nut, 10-32 (2x)	HW55002
7	Pivot arm, short (2x)	4104975
8	Pivot arm, long	4108043
9	Set screw, 8-32 (2x)	4111693
10	Pin	4104343
11	Spacer	4110792-014

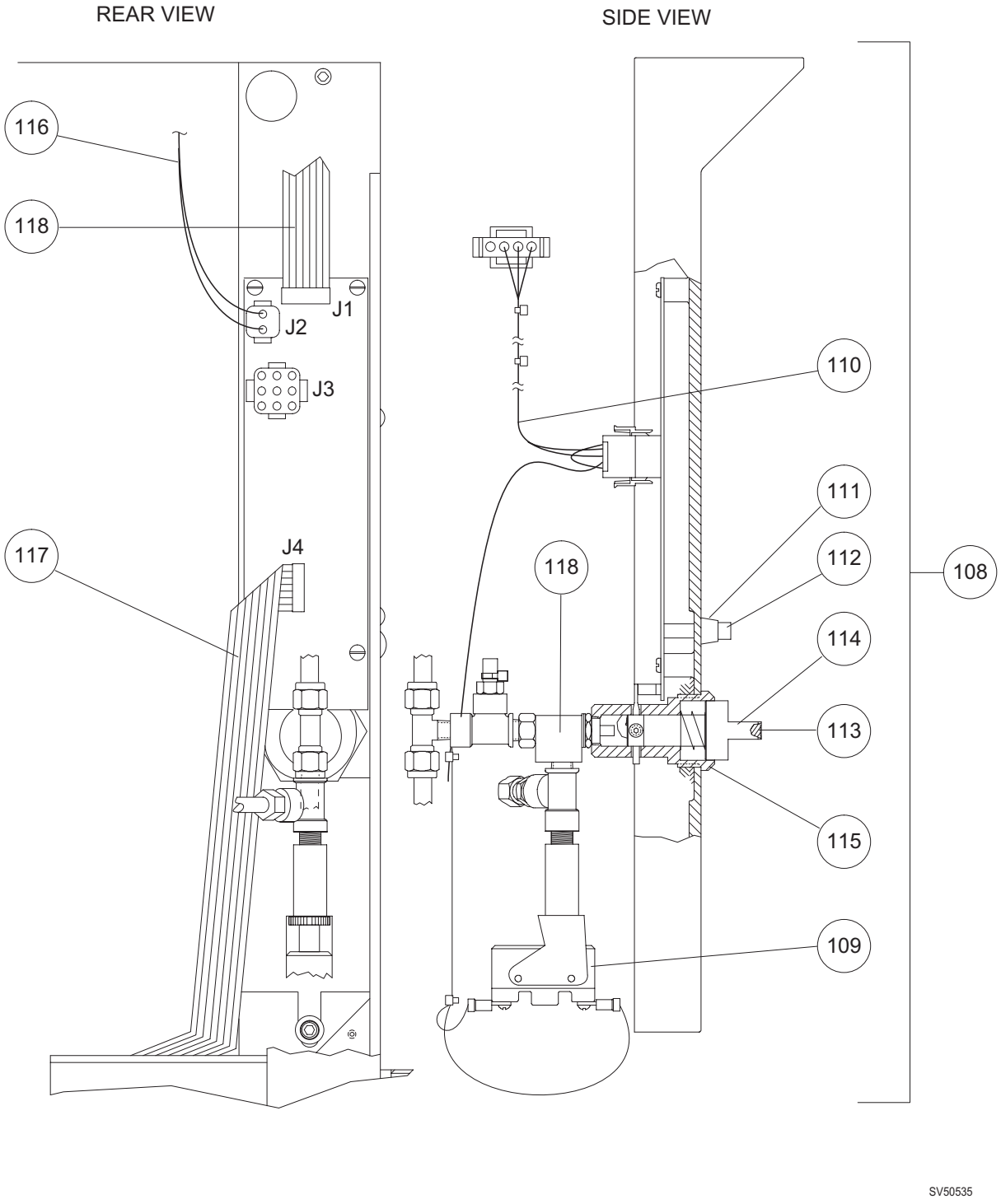
Not shown:

	Support bar	4104976

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED



ITEM	DESCRIPTION	PART NUMBER
101	ORC Assembly	4111800
	Service Exchange	SE4111800
101A	ORC Assembly, low flow design for later machines	4113329-001
	Service Exchange	SE4113329-001
102	O-ring, #105 (Neoprene) (2x)	4111893
103	Filter	4111805
104	O-ring, 0.066 x 0.042 (Buna-n)	4111894
105	Screw, 8-32 x 1½ in. skt hd (3x)	HW01020
106	Lock Washer, #8 split (3x)	HW65001
107	Hose Clamp, Press-on	4104161


REAR VIEW
SIDE VIEW
116
118
J1
J2
J3
117
J4
118
110
111
112
114
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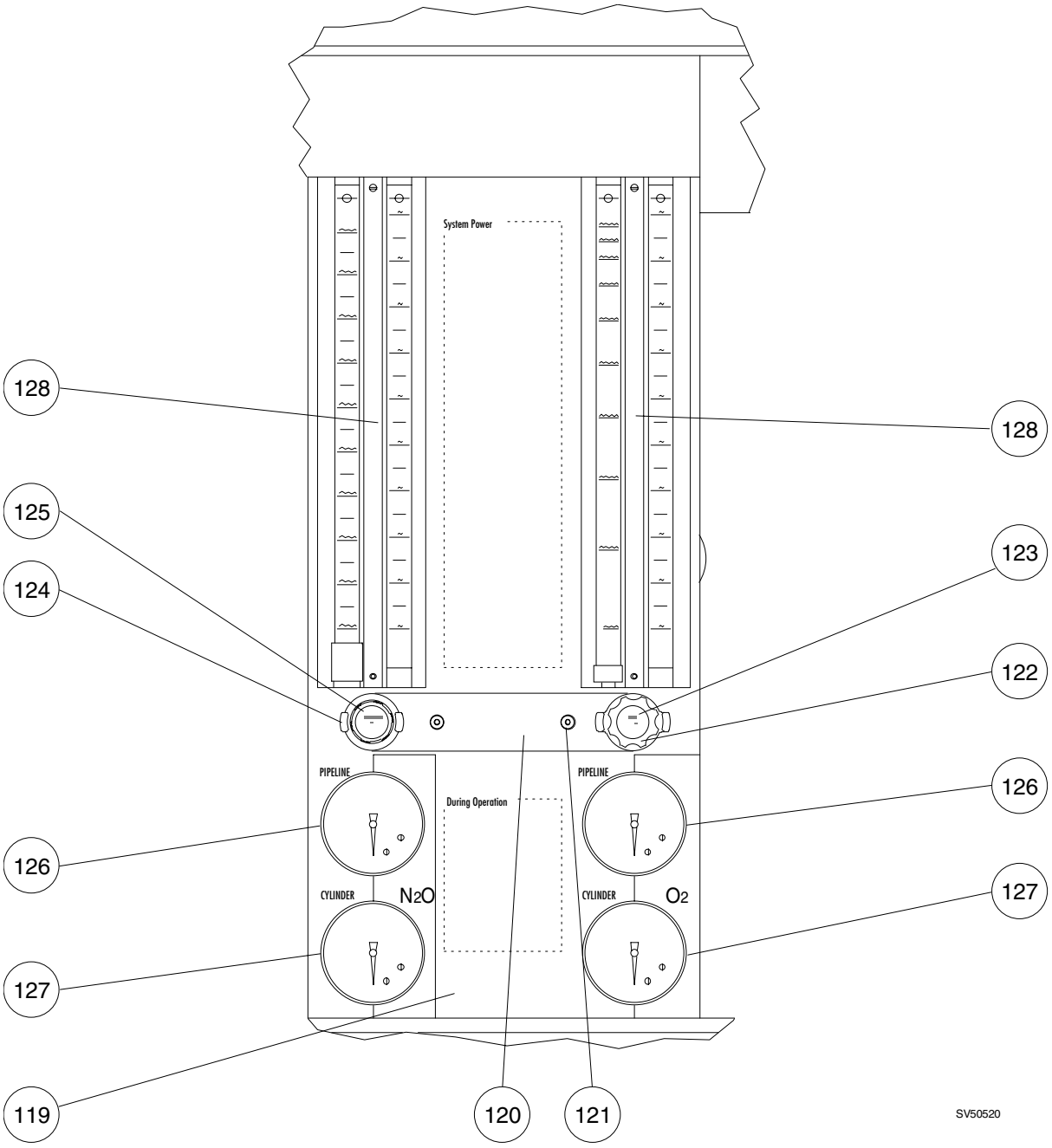
108
SV50535

ITEM	DESCRIPTION	PART NUMBER
108	Alarm Channel Assembly	4112125
109	Oxygen Supply Pressure Alarm Switch	4106037
110	Wire Harness, Alarm Switch & J3 to Ventilator Controller J2	4112146
111	Housing, Push Button	4106046
112	Cap, Push Button	4106047
113	Label, Dot	4103423
114	Knob, Main Switch	4106044
115	Housing, Main Switch	4106045
	Alarm Channel Service Replacement No.	SE10029
	Alarm Channel Service Exchange (O2/N2O LED)	SE4108529
116	Wire Harness, Flowmeter Lights to Alarm Channel J2	4108594
117	Cable Assembly, Power Supply J2 to Alarm Channel J4	4112149-001
118	Cable Assembly, Alarm Channel J1 to Ventilator Box	4109072
118A	Clippard valve	4103588


System Power
During Operation
PIPELINE
PIPELINE
CYLINDER
N_2O
CYLINDER
O_2
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128
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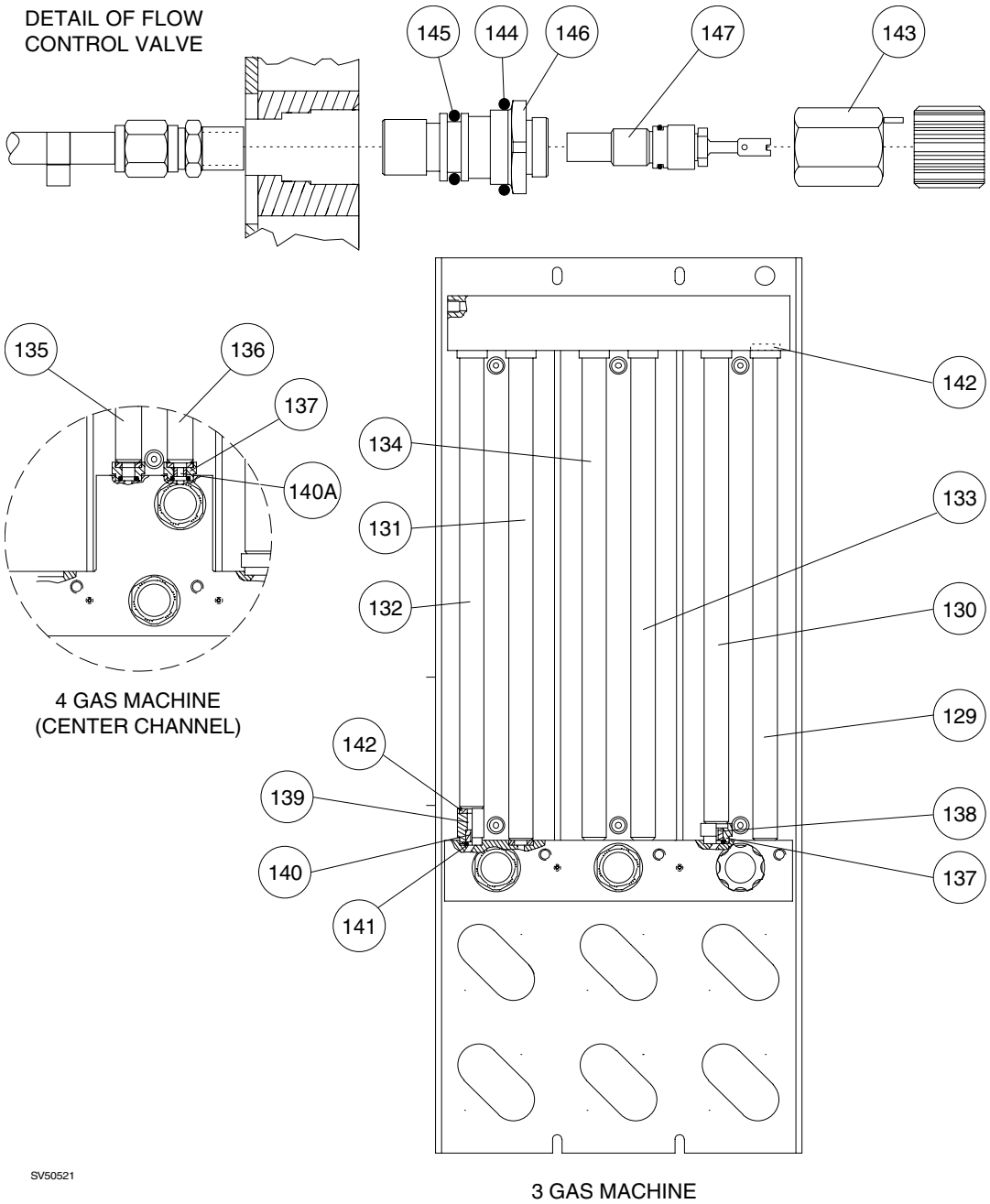
SV50520

ITEM	DESCRIPTION		PART NUMBER
119	Shield, Flowmeter, 2 Gas N_2O/O_2, Domestic		4111824-001
	Shield, Flowmeter, 2 Gas N_2O/O_2, Canada		4111824-002
	Shield, Flowmeter, 2 Gas, Export		4111825
	Shield, Flowmeter, 3 Gas Air, Domestic		4111830-001
	Shield, Flowmeter, 3 Gas O_2-He, Domestic		4111831
	Shield, Flowmeter, 3 Gas Air, Canada		4111830-002
	Shield, Flowmeter, 3 Gas, Export, 6 Gauge		4111826
	Shield, Flowmeter, 3 Gas, Export, 5 Gauge		4111827
	Shield, Flowmeter, 4 Gas, Air/CO_2, Domestic		4111829-003
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Domestic		4111829-001
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Canada		4111829-002
	Shield, Flowmeter, 4 Gas, Export		4111828
120	Knob Guard, 2 Gas		4110621
	Knob Guard, 3 Gas		4110574
121	Screw, 6-32 x 7/16 btn hd (2x)		HW09017
122	Knob, O_2		4103156
123	Label, O_2 Flow Control Knob,	Green (USA)	4103178
		White (UK, Canada)	4105981
		Blue (Germany)	4111266-002
124	Knob, Flow		4103736
125	Label, N_2O Flow Control Knob,	Blue (USA, UK, Canada)	4103904
		Gray (Germany)	4111266-004
	Label, Air Flow Control Knob,	Yellow (USA, Germany)	4103905
		Black/White (UK, Canada)	4105982
	Label, CO_2 Flow Control Knob,	Gray (USA,UK, Canada)	4103908
		Black (Germany)	4111266-006
	Label, O_2-He Flow Control Knob,	Green/Brown (USA)	4110951
		White/Brown (Canada)	4110952
126	Gauge, 100 psi		4110575-001
	Gauge, 7.0 bar		4110575-003
127	Gauge, 3000 psi		4110575-002
	Gauge,200 bar		4110575-004
128	Flowmeter Light Circuit Assembly		4107370


DETAIL OF FLOW
CONTROL VALVE
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140A
4 GAS MACHINE
(CENTER CHANNEL)
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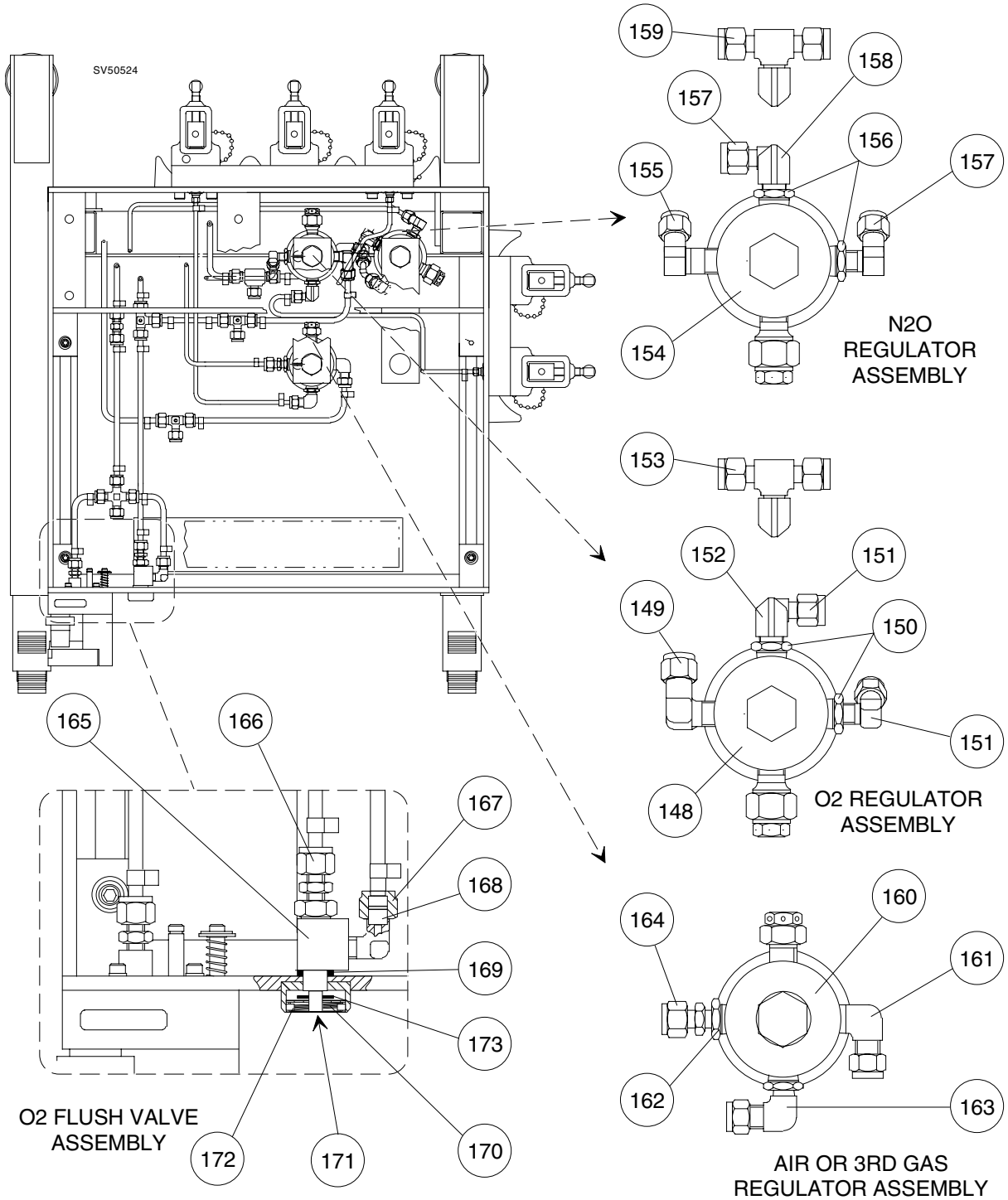
SV50521
3 GAS MACHINE

ITEM	DESCRIPTION	PART NUMBER
129	Flow Tube, O_2, 1-10 l/min	4103418
	Later style w/o color band	4112560-001
	Flow Tube, O_2, 0.6-10 l/min (Low Flow)	4107699
	Later style w/o color band	4112568-001
130	Flow Tube, O_2, 100-1000 ml/min	4103417
	Later style w/o color band	4112559-001
	Flow Tube, O_2, 20-500 ml/min (Low Flow)	4107698
	Later style w/o color band	4112567-001
131	Flow Tube, N_2O, 1-10 l/min	4103420
	Later style w/o color band	4112562-001
	Flow Tube, N_2O, 0.6-10 l/min (Low Flow)	4105758
	Later style w/o color band	4112564-001
132	Flow Tube, N_2O, 100-1000 ml/min	4103419
	Later style w/o color band	4112561-001
	Flow Tube, N_2O, 20-500 ml/min (Low Flow)	4105757
	Later style w/o color band	4112563-001
133	Flow Tube, Air, 1-10 l/min	4106693
	Later style w/o color band	4112566-001
134	Flow Tube, Air, 100-1000 ml/min	4106692
	Later style w/o color band	4112565-001
135	Flow Tube, Air, 0.2-10 l/min (4-gas machines)	1101084
	Later style w/o color band	4112558-001
136	Flow Tube, CO_2, 0.05-1.0 l/min (4-gas machines)	1101081
	Later style w/o color band	4112557-001
	Flow Tube, O_2-He, 2-10 l/min (4-gas machines)	4110956
	Later style w/o color band	4112569-001
137	O_2 Restrictor Housing	4103440
138	O_2 Restrictor, Red (w/ORC & ORMC)	4110738-003
139	N_2O Restrictor Housing	4111716
140	N_2O Restrictor, Black (w/ORC only)	4110738-005
	N2O Restrictor, Blue (w/ORMC only)	4110738-002
140A	Restrictor, Yellow (CO_2 only)	4110738-006
141	O-ring, #010, Neoprene (one per each restrictor housing)	4101872
142	Gasket, Large, 2x per Flow Tube	4102724
Minimum flow O2 restrictors:		
	White, 150 mL/min. (ORMC & ORC)	4110738-004
	Brown, 175 mL/min. (ORC w/bypass)	4110738-007
	Parts common to all flow control valves:	
143	Stop Pin Nut	4103382
144	O-ring, #018, Neoprene	4102336
145	O-ring, #112, Neoprene	4102141
146	Insert, Flow Control Valve, unplated	4111819-001
	plated, (4th gas only)	4111819-002
147	Valve, Flow Control	4103352
	New part number	4115871


SV50524
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157
154
N2O
REGULATOR
ASSEMBLY
153
152
151
149
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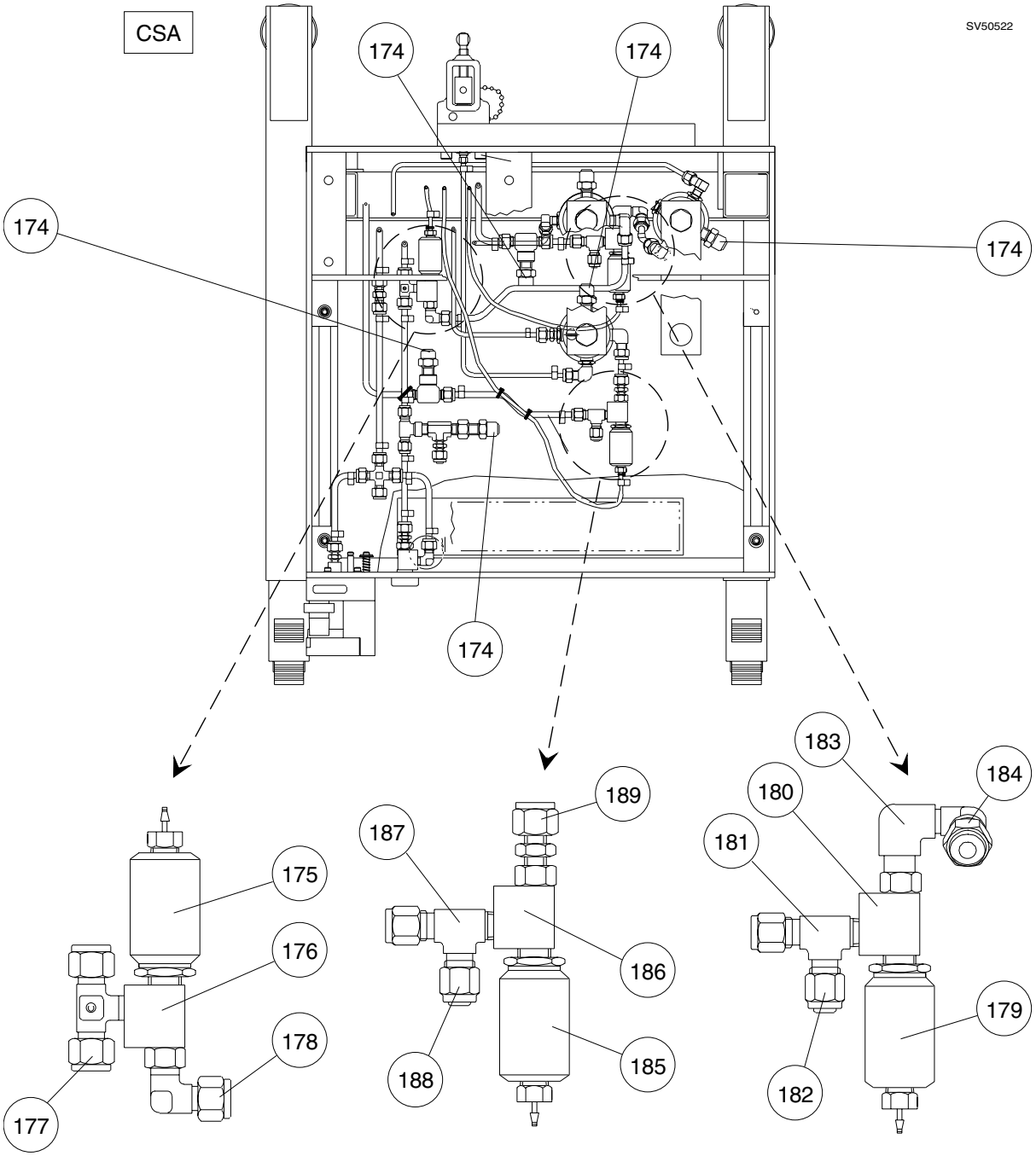
151
148
O2 REGULATOR
ASSEMBLY
165
166
167
168
169
173
O2 FLUSH VALVE
ASSEMBLY
172
171
170
164
160
161
162
163
AIR OR 3RD GAS
REGULATOR ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER
	O_2 Regulator Assembly:	
148	Regulator	4103590
149	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
150	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
151	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
152	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
153	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional O_2 yoke]	4109404
	N_2O Regulator Assembly:	
154	Regulator	4103591
155	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
156	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
157	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
158	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
159	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional N_2O yoke]	4109404
	Air or 3rd Gas Regulator Assembly	
160	Regulator	4103590
161	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
162	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
163	Elbow Fitting, 3/16 Tube x ⅛ MPT	4109409
164	Straight Fitting, 3/16 Tube x ⅛ MPT	4109415
	O_2 Flush Valve and Related Parts:	
165	Valve, Clippard, 2 way	4103340
166	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
167	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
168	Restrictor	4101867
169	Spacer	4110792-006
170	Button, O_2 FLUSH	4103249
171	Label, ⅝ Dot, O_2, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
172	Set Screw, 3-48 x 3/16 (2x)	HW04020
173	Washer	4110792-021

See next page for CSA items.

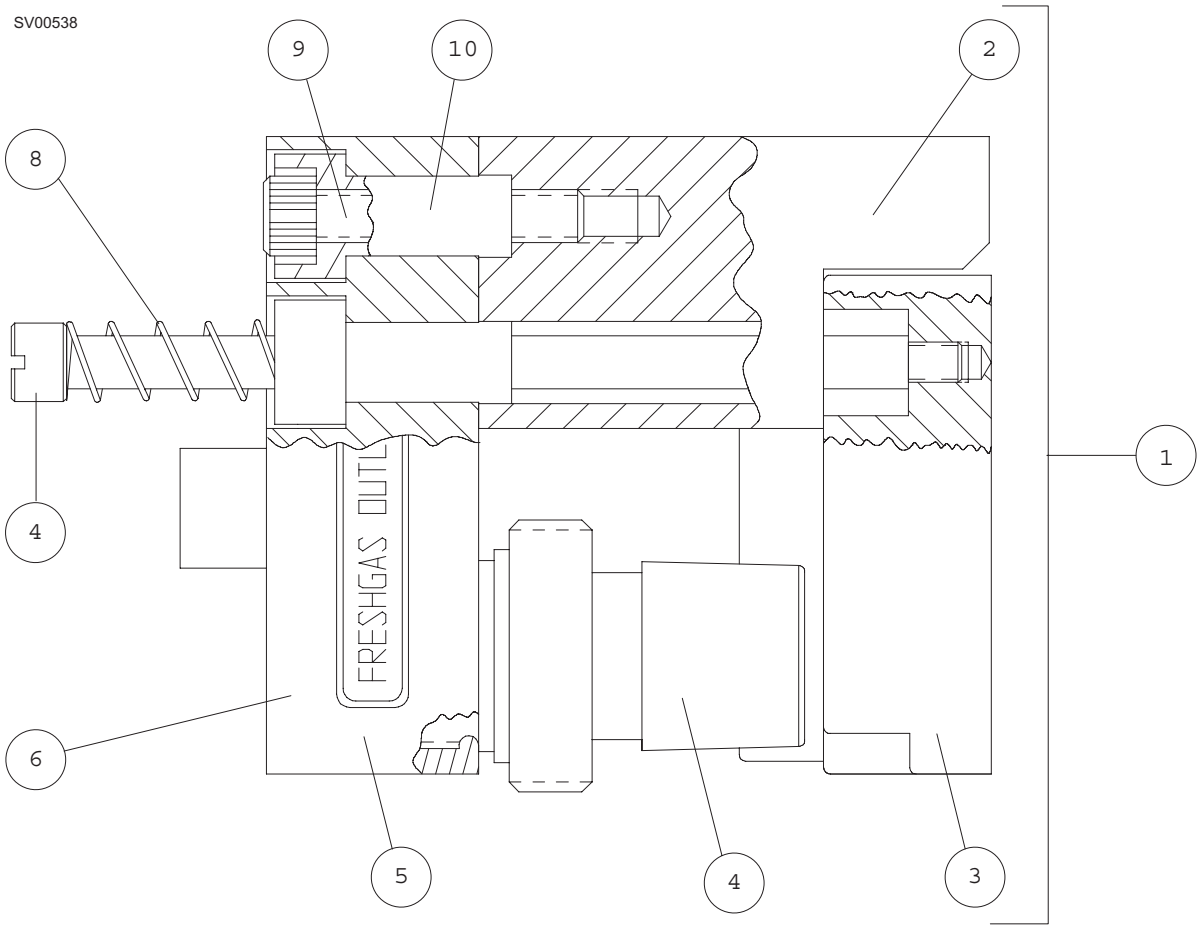


O2 CYLINDER CUTOFF VALVE ASSEMBLY

AIR OR 3RD GAS CYLINDER CUTOFF VALVE ASSEMBLY

N2O CYLINDER CUTOFF VALVE ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER
	CSA Items:	
174	Relief Valve, 70 psi (Canada)	4110364
	O_2 Cylinder Cutoff Valve Assembly (Canada)	
175	Pilot Actuator, Modified	4106498
176	Clippard Valve, MJVO-2	4106218
177	Tee Fitting, ¼ Tube x ¼ Tube x ⅛ MPT	4109406
178	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
	N_2O Cylinder Cutoff Valve Assembly (Canada)	
179	Pilot Actuator, Modified	4106498
180	Clippard Valve, MJVO-2	4106218
181	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
182	Plug, ¼ Tube	4103072
183	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
184	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
	Air or 3rd Gas Cylinder Cutoff Valve Assembly (Canada)	
185	Pilot Actuator, Modified	4106498
186	Clippard Valve, MJVO-2	4106218
187	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
188	Plug, ¼ Tube	4103072
189	Straight Fitting, ¼ Tube x ⅛ MPT	4109408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FRESHGAS OUTL
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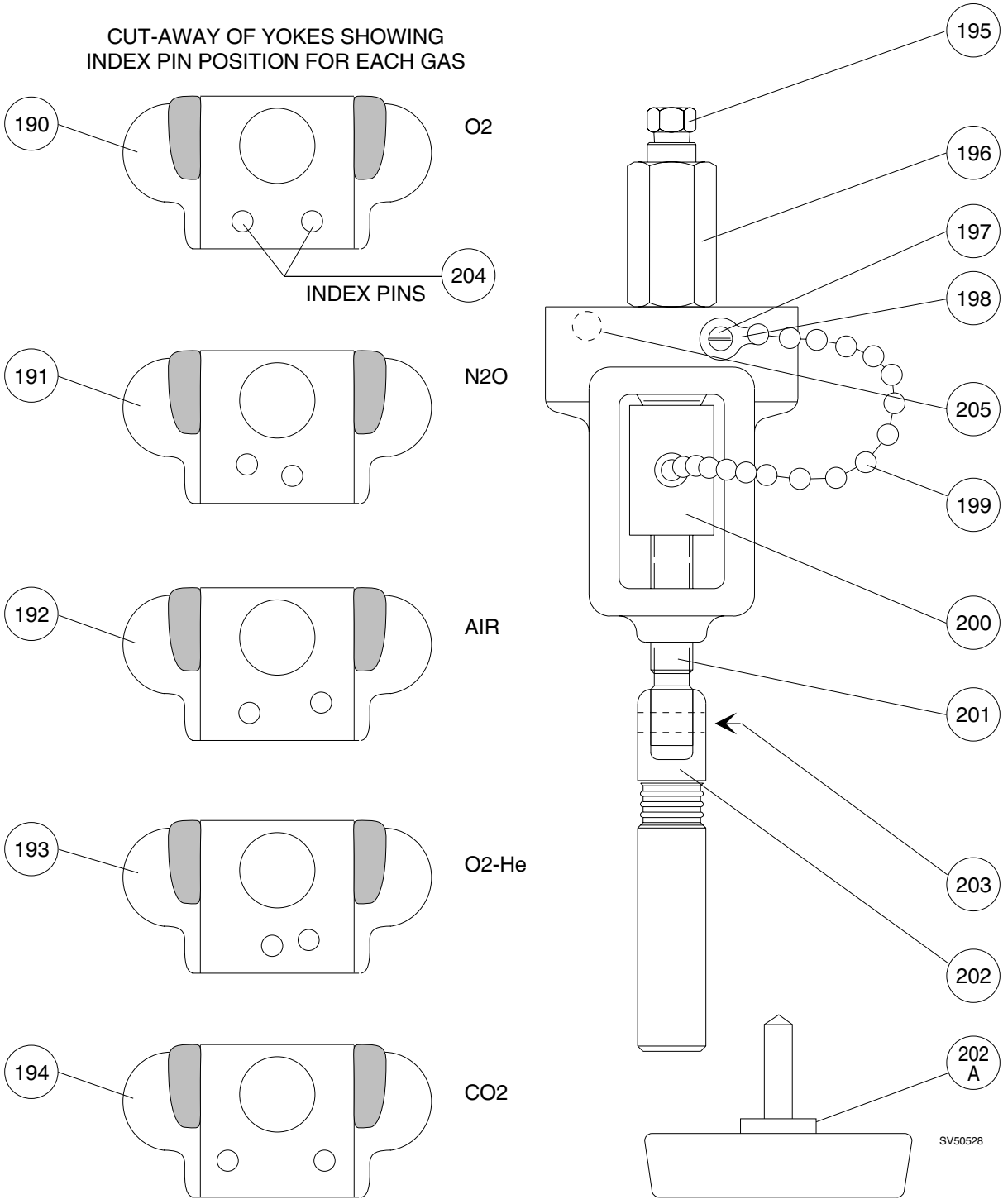
ITEM	DESCRIPTION	PART NUMBER
1	Fresh Gas outlet assembly (Canada)	4109015
2	Block, guide	4110707
3	Plate, locking	4110708-001
4	Common outlet, 15mm x 22mm	4109013
5	Block, solder asm	4108662-001
6	Label, "Freshgas Outlet"	4108666-001
7	Screw, 1/4 OD x 1/4-28 x 4.6 L sltd	4109011
8	Spring, CPRSN, 0.36 OD x 1 3/8 L	4110975-002
9	Screw, 1/4-20 x 1 1/4 L, cap skt hd	HW01039
10	Bushing	4108658


CUT-AWAY OF YOKES SHOWING
INDEX PIN POSITION FOR EACH GAS
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O2
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INDEX PINS
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N2O
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AIR
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O2-He
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CO2
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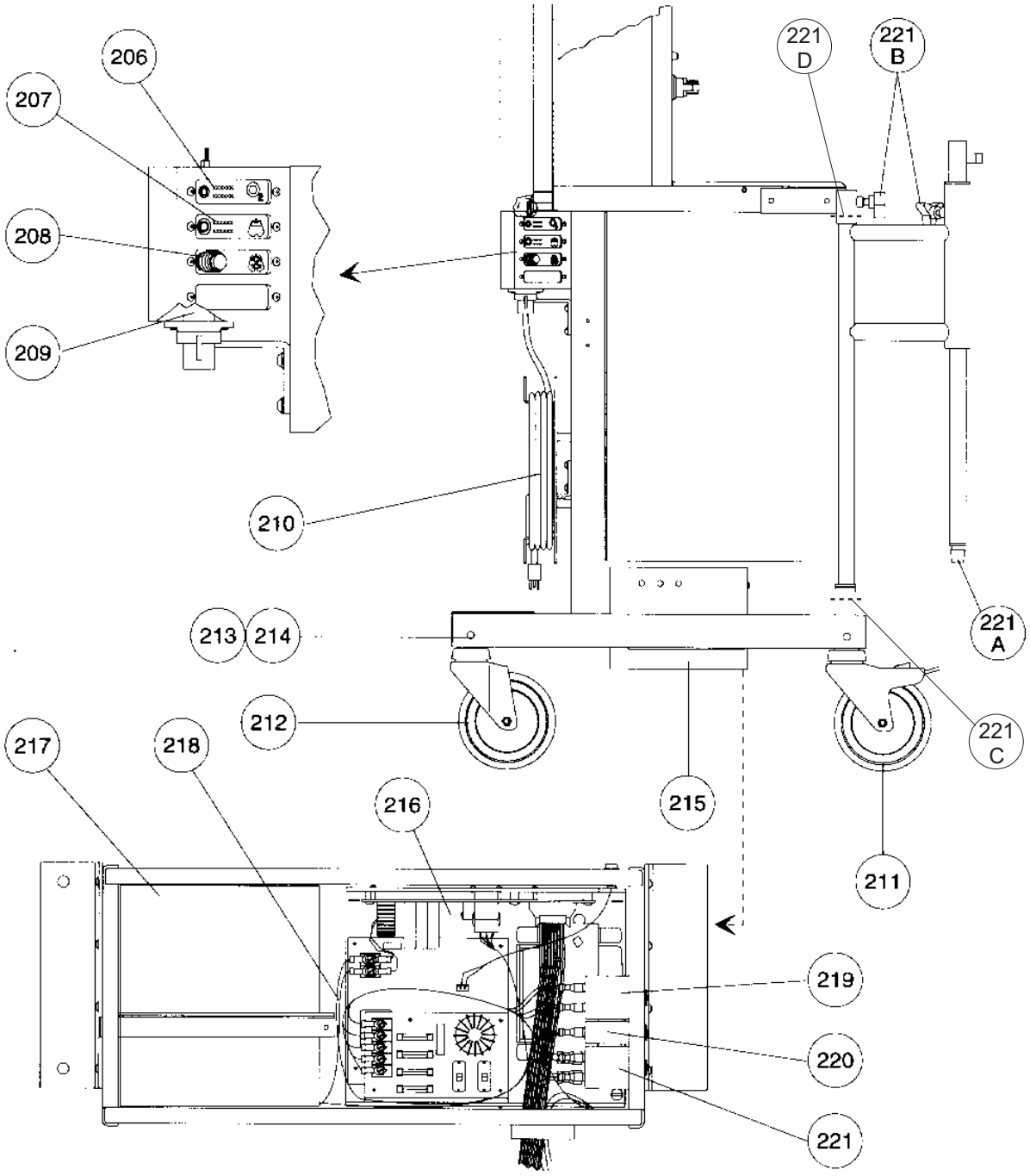
202
A
SV50528

ITEM	DESCRIPTION	PART NUMBER
190	Yoke, O_2	1101620
191	Yoke, N_2O	1101621
192	Yoke, Air	1101625
193	Yoke, O_2-He	4110957
194	Yoke, CO_2	1101624
	Parts Common to All Yokes:	
195	Nut, 3/16 Tube	4104716
196	Check Valve Assembly	4111792
197	Screw, 10-32 x ⅜ in. rd hd	HW06006
198	Chain Coupling	4101868
199	Chain, #10 Bead (5.75 in.)	4103940
	Items 198 and 199 superseded by Chain Assembly	4112495-003
200	Plug	1101655
	Plug assembly includes Items 198, 199, 200	4112755-001
201	Bolt, Toggle Handle	1101556
202	Handle	1101595
202A	Plastic T-handle & bolt (replaces Items 201, 202, 203)	4113536
203	Roll Pin	HW75003
204	Screw (Index Pin) (2x per yoke)	4105929
205	Yoke Labels:	
	Label, O_2, Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Label, N_2O, Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003
	Label, Air, Yellow (USA, Germany)	4102742
	Black/White (UK)	4103826
	Label, O_2-He, Green/Brown (USA)	4110950
	White/Brown (Canada)	4110942
	Label, CO_2, Gray (USA, UK)	1101639
	Black (Germany)	4111266-005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221 D
221 B
221 A
221 C

ITEM	DESCRIPTION	PART NUMBER
206	O_2 Sensor Interface Panel Asm (Incl. Cable to Processor)	4110136
207	Spiromed Interace Panel Asm (Incl. Cable to Processor)	4111994-001
208	Baromed Interface Panel Asm (Incl. Tubing to Processor)	4108996
208A	Man/Auto Sensor Interface Panel Asm. (machines w/AV-2+ ventilator) (incl cable to ventilator controller)	4113090-001
209	Filter, AC Power Inlet	4109578
210	AC Power Cord Assembly	4109600
	AC Power Cord Assembly (Export)	4110625
211	*Caster W/Brake (2x)	4111849
	*Caster W/Brake (2x)	4113006-002
212	*Caster W/O Brake (2x)	4111850
	*Caster W/O Brake (2x)	4113006-001
213	Setscrew, Caster (4x)	HW04017
214	Hole Plug, (4x)	4102729
215	Primary Power Supply (Complete Assembly)	4111962
216	Power Supply	4111958
	Service Exchange	SE4111958
217	Battery, 12V Rechargeable	4111957
218	Battery Wire Harness	4111998
219	Circuit Breaker, 2.5 Amp	4110537-009
220	Circuit Breaker, Battery, 15 Amp	4111379-001
221	Circuit Breaker, 5 Amp	4110537-002
221A	Absorber Pole	1101724
221B	Wing Screw, ⅜-16 x 1 in.	1100078
221C	Roll pin, 0.125 dia x 3/8 in.	HW75004
221D	Roll pin, 0.250 dia x 1 in.	HW75005

*NOTE: There is a one inch height difference between the 4111849/4111850 caster and the 4113006 caster. The 4111849/4111850 caster is one inch taller, and contains a washer on the post.

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ITEM	DESCRIPTION	PART NUMBER
222	Deleted	
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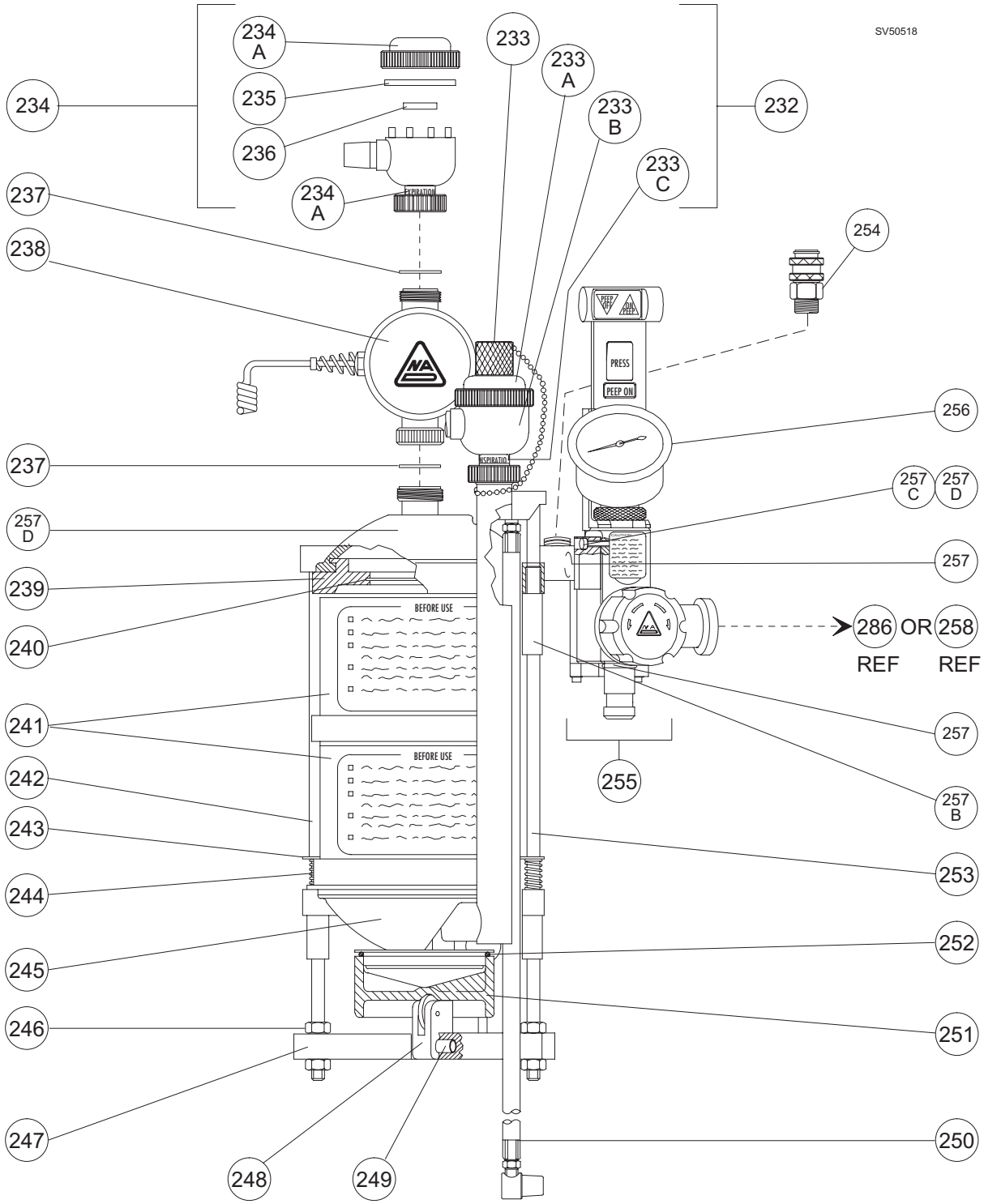
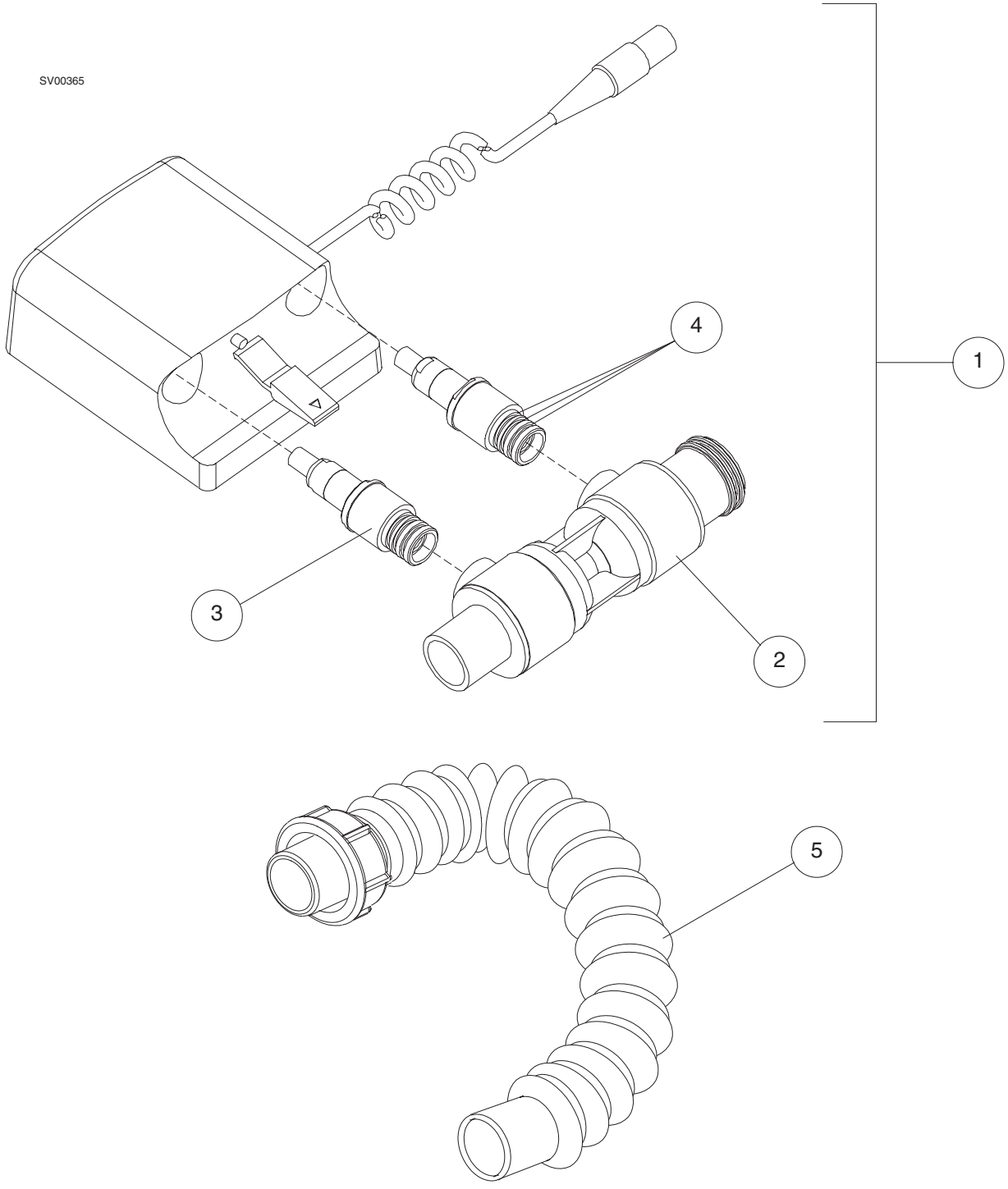
231	Deleted	

SPARE AND REPLACEMENT PARTS (continued) NM2C



ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly	4109430
	Absorber Assembly with PEEP and bypass valve	4109431
232	Inspiratory Valve Assembly (incl. O_2 sensor mount)	4112773-001
	Ref: Valve w/o O_2 Sensor Mount (old no.)	2122810
233	Plug Assembly, Oxygen Sensor	4106387
233A	Dome & Label, Insp. Valve	4108329
233B	Valve Asm .....4112151 Service Exchange	SE4112151
233C	Label, Inspiration	1100559
234	Expiratory Valve Assembly (old no.)	2122812
	(new no.) .....4112150 Service Exchange	SE4112150
234A	Dome	2109230
235	Gasket, Valve Dome (Both Valves)	2109231
236	Disk (Both Valves)	2123249
236A	Label, Expiration	1100565
237	Gasket, Valve Mount	1101690
238	Spiromed Sensor .....4106362 Service Exchange	SE4106362
239	Gasket, Canister Top	4105848
240	Screen, Canister	1100022
241	Canister Assembly (2x)	4105851
242	Rod, Left	1101356
243	Clip, E-Ring (2x)	1100097
244	Spring (2x)	4110975-010
245	Bottom Sub-Assembly	4108358
	later replaced by	4112932
	Gasket, absorber bottom (not shown)	1101001
246	Nut, ⅜-16 SS (4x)	HW50010
247	Cam Bar (2x)	1101018
248	Cam Assembly	1101015
249	Dowel Pin	1101017
250	Hose Assembly, Fresh Gas	4108577
251	Dust Cap	4106874
252	O-Ring	4102940
253	Rod, Right	1101355
254	Quick Disconnect Fitting (Breathing Pressure)	4108139
255	PEEP Bypass and Valve Assembly	4111527
	Magnet assembly	4114419
	O-ring, #126 (neoprene)	4111878
	Knob	4113558
256	Gauge Assembly, Breathing Pressure (Incl Mtg Ring and O-Ring)	4105853
	Later design gauge assembly with additional scale in hPa	4115275
	Replacement Cover	4113387
	Replacement Ring	4113388
257	O-Ring, #117, Silicone (2x)	4105766
257A	Dome assembly, chrome	1101351
257B	Bushing	1101023
257C	Screw, 8-32 x 1/2 in.	HW01014
257D	Lock Washer, #8 split	HW65011
	Breathing press hose asm (quick disc. ftg on each end)	4109368
	Breathing press hose asm (quick disc. ftg one end, Luer fitting other end)	4108528
	Quick disc. fitting, male	4108137
	Clear hose	ML08007
	O_2 Sensor: Complete Assembly, including capsule	4110374
	Sensor Capsule	6850645
	Housing Assembly	4106363
	Adapter (cover)	4106385
	O-ring, #025 (viton)	4105791
	O-ring, #016 (viton) (2x)	4106388


SV00365
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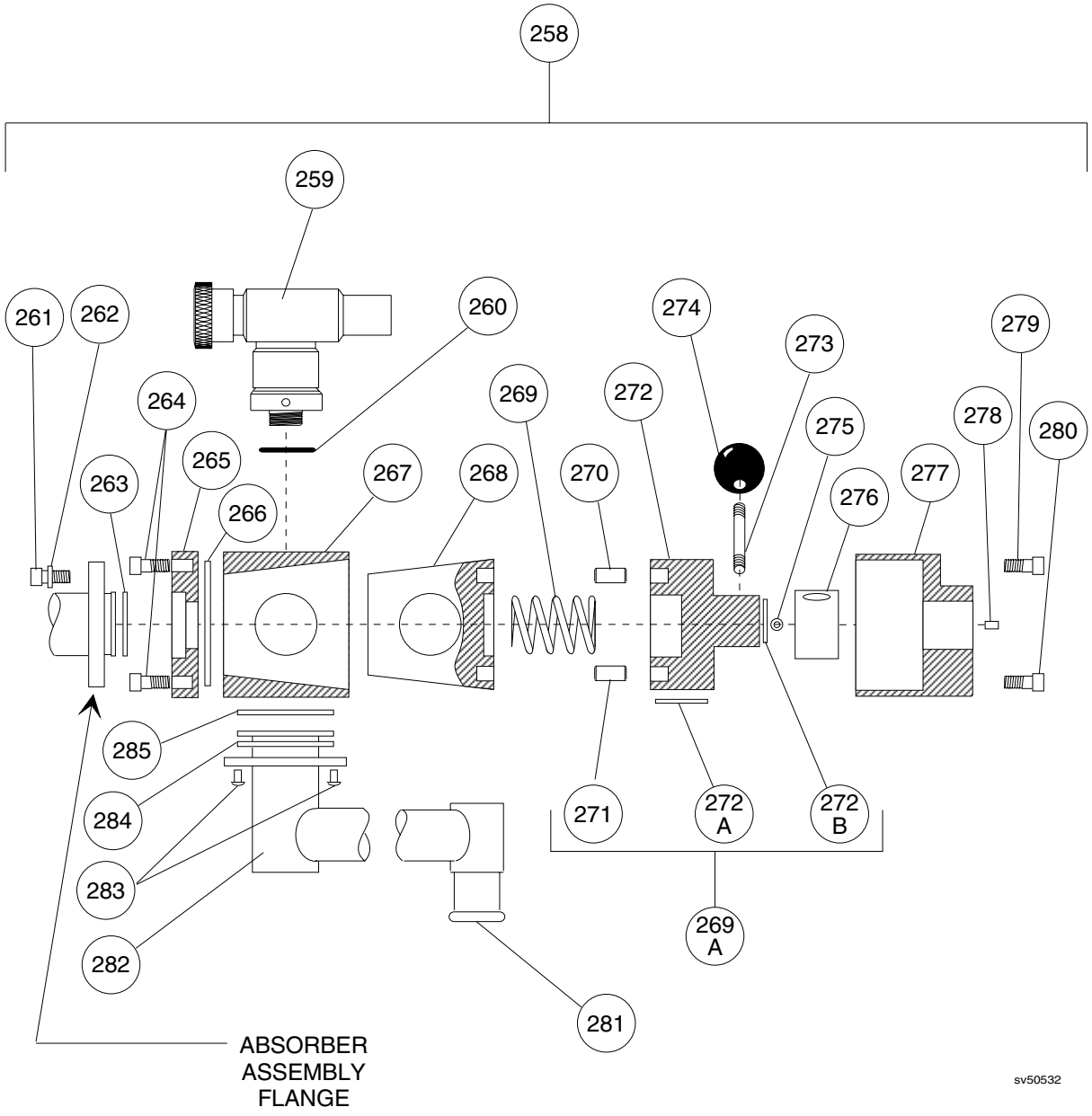
ITEM	DESCRIPTION	PART NUMBER
1	Ultrasonic Flow Sensor Assembly	4115754
	Service Exchange part number	4115777
2	Flow Housing	4114444
3	Transducer - set of two, incl. O-rings	4114445
4	O-ring - set of six	4115147
5	Connector Hose	4114912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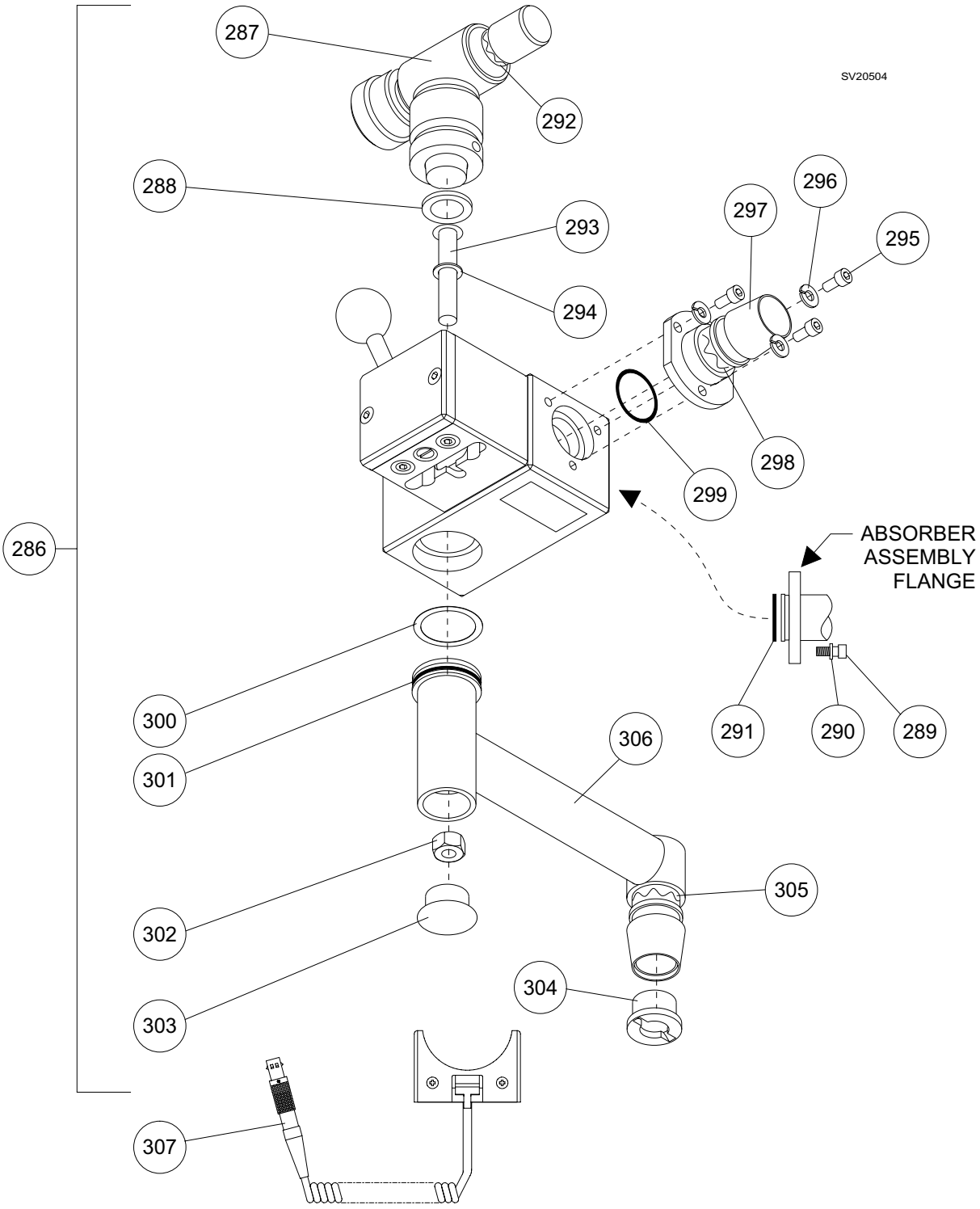
272 A
272 B
269 A
281
ABSORBER ASSEMBLY FLANGE
sv50532

ITEM	DESCRIPTION	PART NUMBER
258	Valve, Man/Auto Selector	4102698
259	APL Valve	4104839
260	Fiber Washer	(Supplied with APL Valve)
261	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
262	Lock Washer, Selector Valve Mounting #8 int-t (3x)	HW67000
263	O-Ring, Neoprene	4102941
264	Screw, Adapter Flange Mounting, 8-32 x ½ in. (4x)	HW01014
265	Adapter Flange	4102694
266	O-Ring, Silicone	4105767
267	Valve Housing	4102734
268	Valve Channel	4102692
269	Spring	4110975 P-005
269A	Switch Assembly	4102700
270	Dowel Pin, 0.187 x ¾ in.	HW76002
271	Dowel Pin, 0.250 x ⅝ in.	HW76003
272	Valve Switch	4102690
272A	Label, Bag/Auto	4102699
272B	Label, Dot NAD	1101098
273	Stem	1101011
274	Ball	4101848
275	Ball Bearing (2x)	1101637
276	Cover	4103118
277	Valve Switch Block	4102691
278	Set Screw, Adjustment, ¼-28 x ¼ in. (2x)	HW04014
279	Screw, Valve Switch Block Mounting, Upper, 8-32 x ¼ in. (2x)	HW01019
280	Screw, Valve Switch Block Mounting, Lower, 8-32 x ½ in. (2x)	HW01020
281	Bag Connector	4102894
282	Swivel Bag Mount Assembly	1101334
283	Screw, Bag Mount, 8-32 x ⅜ in. (4x)	HW02015
284	O-Ring, Silicon	4105868
285	Glide Ring, Teflon	1101335


SV20504
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ABSORBER
ASSEMBLY
FLANGE
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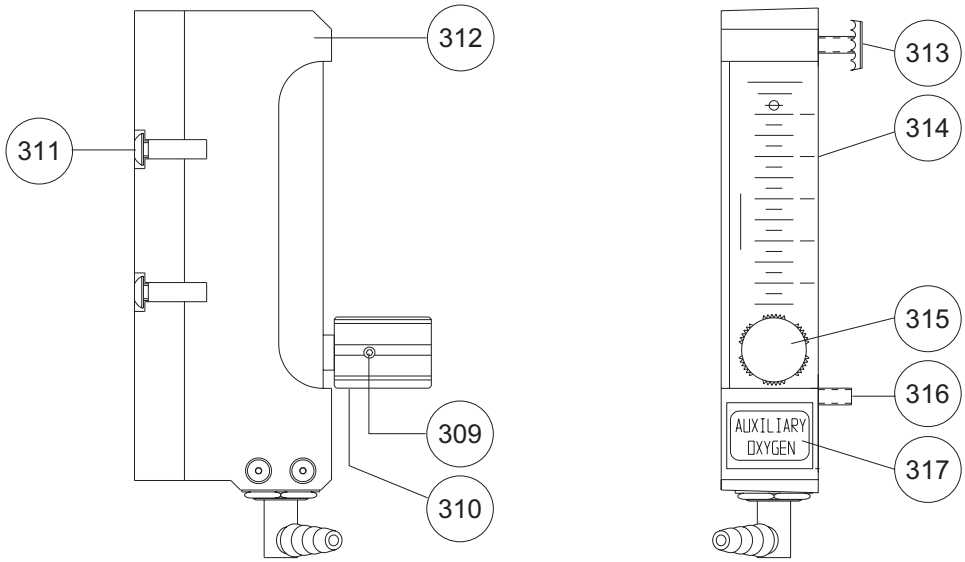
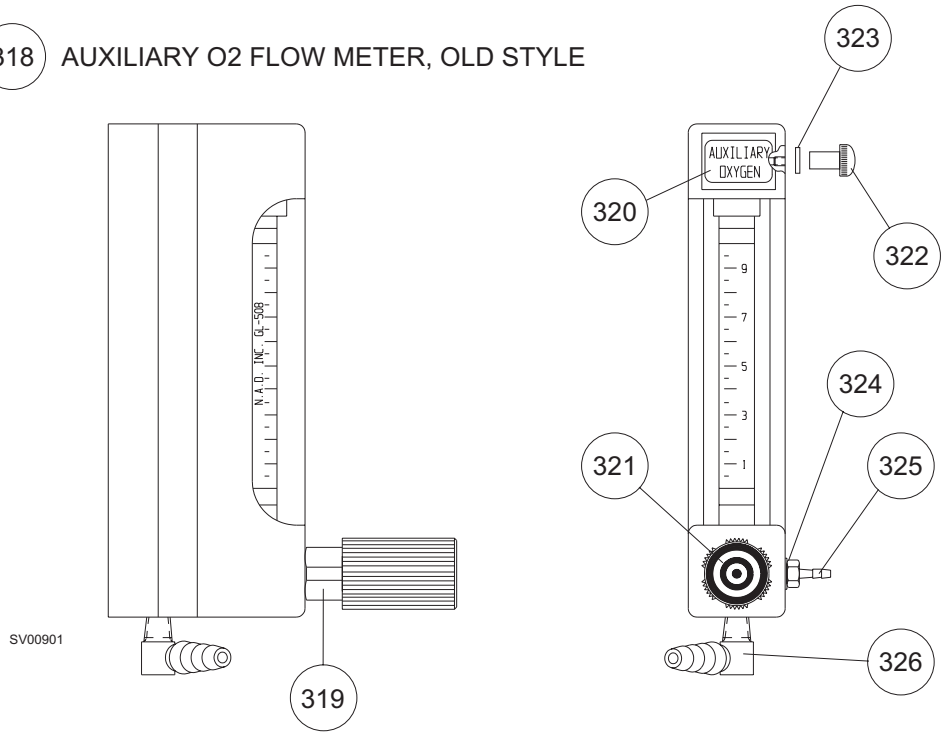
ITEM	DESCRIPTION	PART NUMBER
286	Valve, Man/Auto Selector (later design)	4112217-001
	Service Exchange	SE4112217-001
287	APL Valve	4104839
288	Fiber Washer	(Supplied with APL Valve)
289	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
290	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
291	O-Ring, #117 Silicone	4105766
292	Label, "Scavenger Hose"	4104806
293	Screw, 5/16-18 x 3¾ in. Rd Hd	HW06023
294	Spacer	4110792-070
295	Screw, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
296	Lock Washer, #8 split (3x)	HW65011
297	Connector Assembly, 22mm	4106744
298	Label, "Ventilator Hose"	1100563
299	O-Ring, #117 Silicone	4105766
300	Spacer	4110792-071
301	O-Ring, #120 EPDM	4112629-001
302	Nut, 5/16-18 Hexseal	4112613-001
303	Hole Plug, 3/16 in. dia.	4111663-001
304	Bag Connector	4102894
305	Label, "Breathing Bag"	1100561
306	Bag Mount Assembly	4112622-001
307	Man/Auto Sensor Cord Asm. (for AV-2+ ventilator)	4113126
	SpO_2 Sensor	4108983
	Form, Narkomed 2C PMS Checklist	S010211

308 AUXILIARY O2 FLOW METER, NEW STYLE



318 AUXILIARY O2 FLOW METER, OLD STYLE



ITEM	DESCRIPTION	PART NUMBER
308	Auxiliary O_2 Flow Meter Assembly, new style	4109310
309	Set Screw, cup point, 6-32 x ¼ in.	HW04003
310	Knob	4111442
311	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
312	Housing	4111053
313	Kep nut, 10-32 (2x)	HW55002
314	Flowmeter (incl. tube & valve)	4111460
315	Label, ⅝ w/dot and green & white rings	4109373
316	Set Screw, cup point, 10-32 x ⅞ (2x) (used as mtg stud)	HW04011
317	Label, AUXILIARY OXYGEN	4109381
318	Auxiliary O_2 Flow Meter Assembly, old style	4109391
319	Valve, flow control, sub-compact	S0B7121
320	Label, AUXILIARY OXYGEN	4109381
321	Label, ⅝ w/dot and green & white rings	4109373
322	Screw, 10-32 x 5/8 in. cap skt hd	HW01027
323	Flat washer, #10	HW66003
324	Fiber washer	4102165
325	Hose barb ftg, 10-32 x 1/16 hose	4103445
326	Ell, 3/16 hose	4109387
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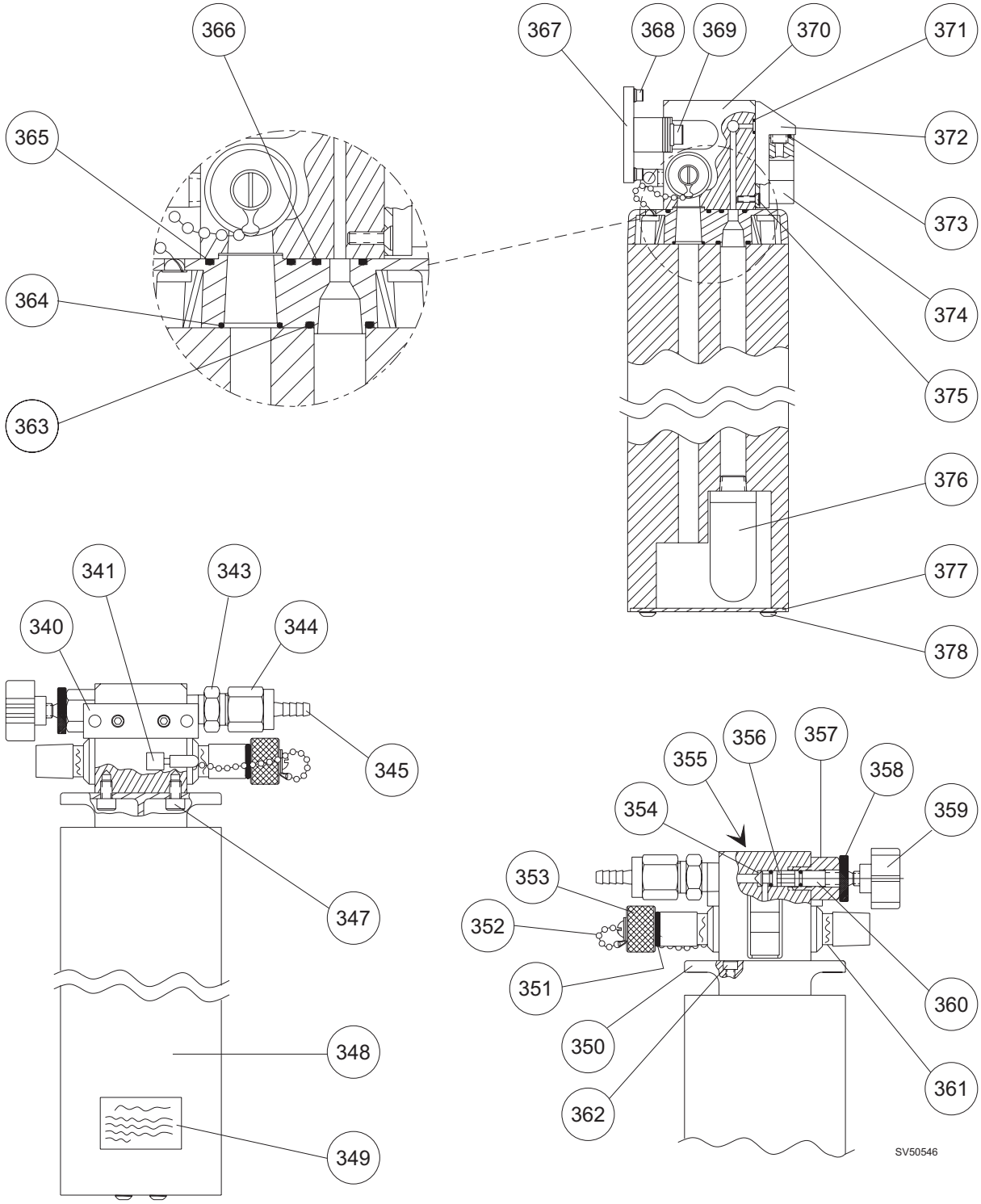
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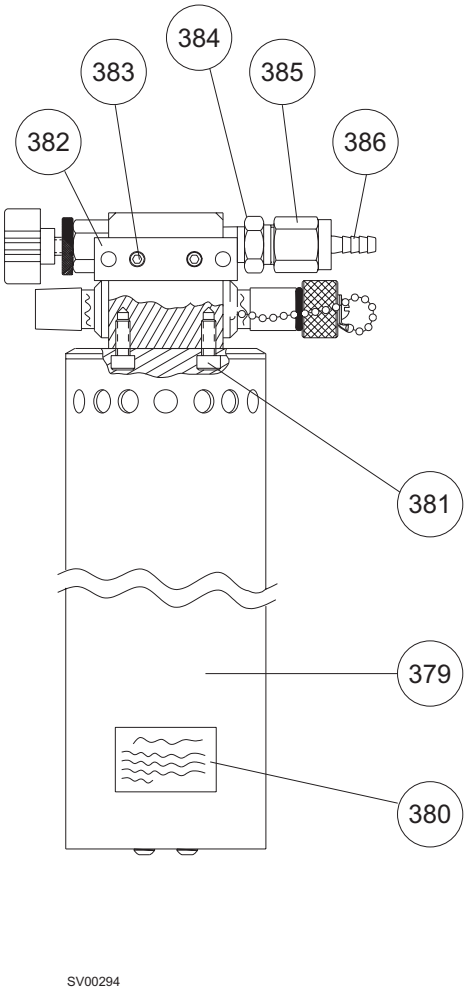
SV50546

ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	4107624
340	Mounting Bracket	4109314
341	Elbow, ⅛ M x ¼ in. hose	4106881
342	Deleted	
343	Body, DISS VAC x ¼ MPT	4103669
344	Nut, DISS VAC	4103122
345	Hose Barb Nipple	4103123
346	Deleted	
347	Screw, ¼-20 x ⅜ in. skt hd (2x)	HW01033
348	Reservoir	4110982
349	Label, CAUTION	4104294
350	Reservoir Top	4110979
351	O-ring #112 (neoprene)	4102141
352	Chain, 8¼ lg	4112495-005
353	Plug	4102140
354	O-ring #008 (neoprene)	4102022
355	Label, ACTIVATE HOSPITAL VACUUM	4109305
356	Retaining Ring	4110997
357	Nut, Valve Stem Retainer	4109316
358	Lock Nut, ⅜-24	4112137
359	Wing Nut	4105699
360	Spindle	4112138
361	Label, SCAVENGER HOSE (2x)	4104806
362	Screw, 10-32 x ¾ in. skt hd (4x)	HW01028
363	O-ring #019 (neoprene)	4106458
364	O-ring #015 (neoprene)	4104602
365	O-ring #019 (neoprene)	4106458
366	O-ring #013 (neoprene)	4102234
367	Bracket Assembly	4106231
368	Screw, 10-32 x ½ in. skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
369	Screw, ¼-20 x ½ in. skt hd (2x)	HW01034
	Lock Washer, ¼ int-t (2x)	HW67005
370	Block	4111002
371	O-ring, #008 (neoprene)	4102022
372	Flowmeter Housing	4110980
373	O-ring, #012 (neoprene)	1101523
374	Flowmeter	4112289
375	Screw, 6-32 x ⅜ in. flat hd (2x)	HW05006
376	Silencer	4110999
377	Reservoir Cap	4111000
378	Screw, 10-32 x ⅜ in. btn hd (4x)	HW09005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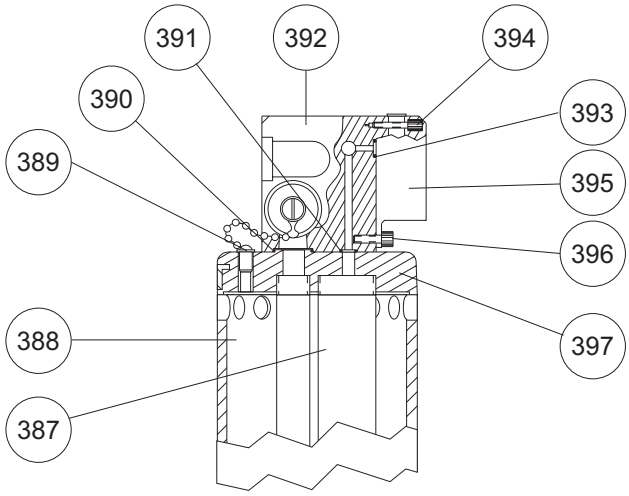
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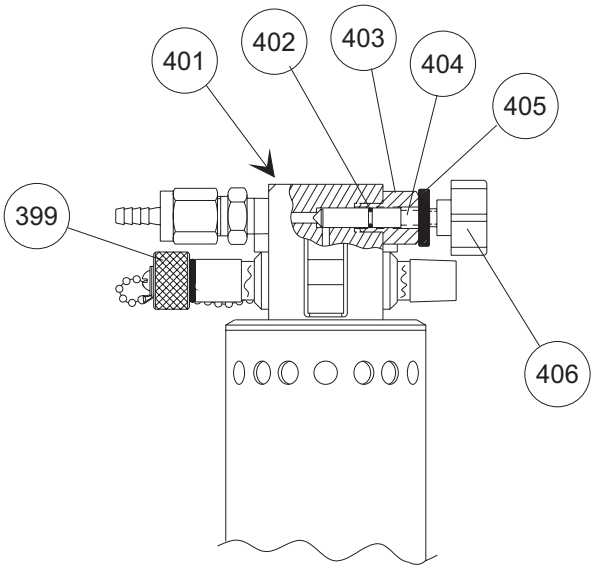
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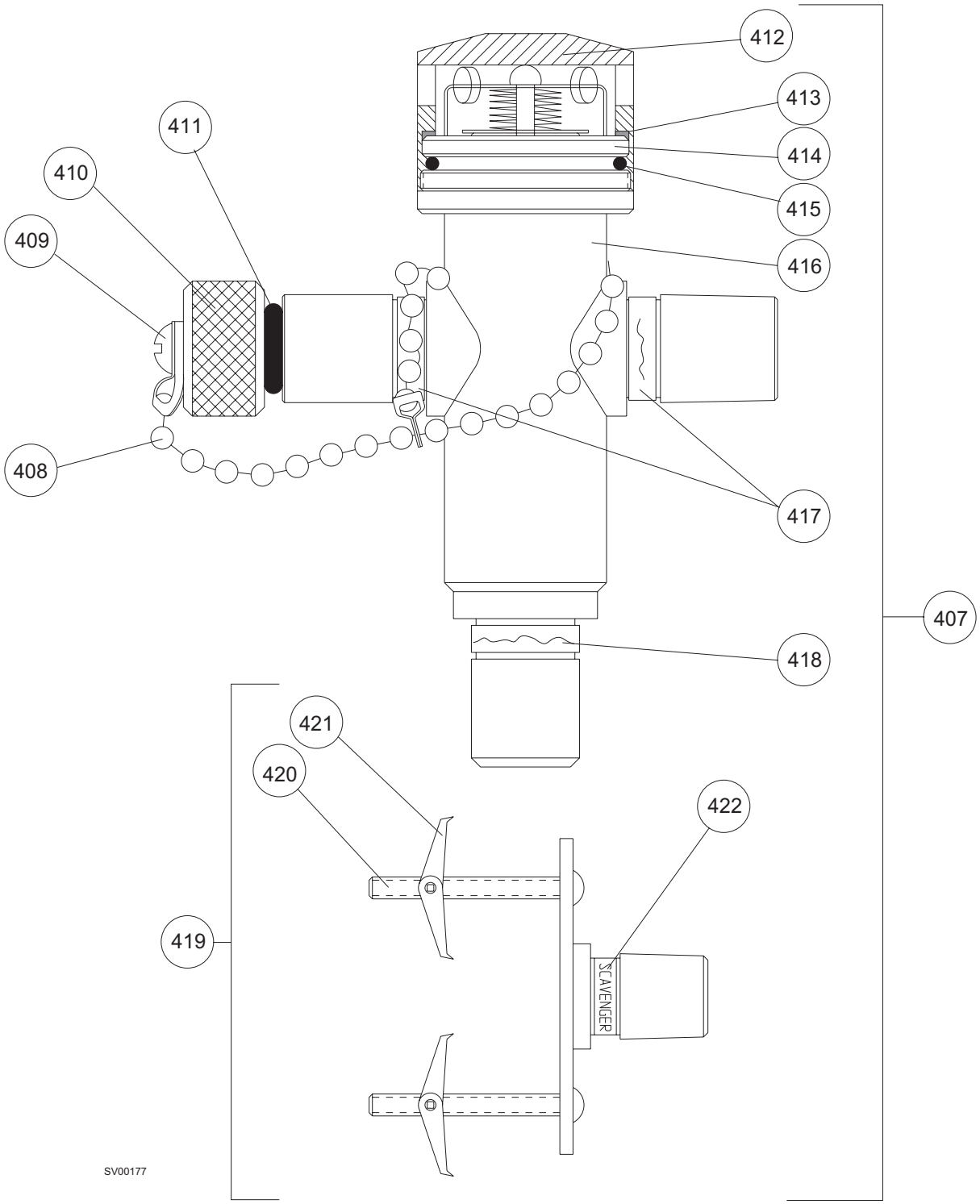
ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly, old style	4109321
379	Reservoir Assembly	4109320
380	Label, CAUTION...	4104294
381	Screw, cap skt hd, ¼-20 x ¾ in. (2x)	HW01036
382	Mounting Bracket	4109314
383	Screw, flat hd, 8-32 x ¾ in. (2x)	HW03026
384	DISS body x ¼ MPT	4103669
385	DISS nut	4103122
386	Hose barb	4103123
387	Tube, 1 in. dia	4109312
388	Tube, ¾ in. dia	4109311
389	Screw, btn hd, 10-32 x ⅜ in.	HW09005
390	O-ring, #016 neoprene	4109322
391	O-ring, #010 neoprene	4101872
392	Block	4109309
393	O-ring, #008 neoprene	4102022
394	Screw, cap skt hd, 6-32 x ⅝ in.	HW01067
395	Flowmeter	4109306
396	Screw, cap skt hd, 6-32 x ¼ in.	HW01007
397	Top, Scavenger Reservoir	4109307
398	Deleted	
399	Plug assembly	4102098
400	Deleted	
401	Label, ACTIVATE HOSPITAL VACUUM	4109305
402	O-ring, #008 neoprene	4102022
403	Nut, valve stem retainer	4109316
404	Spindle	4102068
405	Lock nut, ⅜-24	4105990
406	Wing nut	4105699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SCAVENGER
SV00177

ITEM	DESCRIPTION	PART NUMBER
407	Scavenger, A/C	4106161
408	Chain assembly, 8¼ in.	4112495-006
409	Screw, round hd, 10-32 x ½ in.	HW06007
410	Plug	4102140
411	O-ring, #112 neoprene	4102141
412	Dust cover	1101527
413	Spacer	4110792-007
414	Valve 'A' 5 cm H_2O	2207032
415	O-ring, #027 neoprene	4101871
416	Body, solder assembly	4102105
417	Label, SCAVENGER HOSE (2x)	4104806
418	Label, EXHAUST	4106878
419	Vent Grill Adapter (for 19 mm hose)	1101312
420	Screw, round hd, 10-24 x 3 in. (2x)	HW06012
421	Toggle nut (2x)	4101862
422	Label, SCAVENGER HOSE	4104806
423	Deleted	
	Hose Barb Adapter	4108114

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Narkomed 2C Service Manual

Rev. AB summary of changes

Page	Description
6-1 thru 6-57	Entire section revised to reflect PMC nomenclature

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Printed in the U.S.A.